

# PATENT COOPERATION TREATY

## PCT

### NOTIFICATION OF ELECTION

(PCT Rule 61.2)

From the INTERNATIONAL BUREAU

To:

Commissioner  
US Department of Commerce  
United States Patent and Trademark  
Office, PCT  
2011 South Clark Place Room  
CP2/5C24  
Arlington, VA 22202  
ETATS-UNIS D'AMERIQUE  
in its capacity as elected Office

<b>Date of mailing (day/month/year)</b> 07 May 2001 (07.05.01)	
<b>International application No.</b> PCT/SE00/01589	<b>Applicant's or agent's file reference</b> T022-316/PC
<b>International filing date (day/month/year)</b> 18 August 2000 (18.08.00)	<b>Priority date (day/month/year)</b> 26 August 1999 (26.08.99)
<b>Applicant</b> DÄCKER, Carl-Åke et al	

1. The designated Office is hereby notified of its election made:

☒ in the demand filed with the International Preliminary Examining Authority on:

09 February 2001 (09.02.01)

☐ in a notice effecting later election filed with the International Bureau on:

2. The election ☒ was

☐ was not

made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland  Facsimile No.: (41-22) 740.14.35	<b>Authorized officer</b>  Claudio Borton  Telephone No.: (41-22) 338.83.38
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## PATENT COOPERATION TREATY

PCT

From the INTERNATIONAL BUREAU

NOTICE INFORMING THE APPLICANT OF THE  
COMMUNICATION OF THE INTERNATIONAL  
APPLICATION TO THE DESIGNATED OFFICES

(PCT Rule 47.1(c), first sentence)

To:

SIEBMANN, H.  
Gotapatent AB  
Box 154  
S-561 22 Huskvarna  
SUÈDE

Date of mailing (day/month/year) 01 March 2001 (01.03.01)		IMPORTANT NOTICE	
Applicant's or agent's file reference T022-316/PC			
International application No. PCT/SE00/01589	International filing date (day/month/year) 18 August 2000 (18.08.00)	Priority date (day/month/year) 26 August 1999 (26.08.99)	
Applicant TOUR & ANDERSSON HYDRONICS AB et al			

1. Notice is hereby given that the International Bureau has communicated, as provided in Article 20, the international application to the following designated Offices on the date indicated above as the date of mailing of this Notice:

AU,KP,KR,US

In accordance with Rule 47.1(c), third sentence, those Offices will accept the present Notice as conclusive evidence that the communication of the international application has duly taken place on the date of mailing indicated above and no copy of the international application is required to be furnished by the applicant to the designated Office(s).

2. The following designated Offices have waived the requirement for such a communication at this time:

AE,AG,AL,AM,AP,AT,AZ,BA,BB,BG,BR,BY,BZ,CA,CH,CN,CR,CU,CZ,DE,DK,DM,DZ,EA,EE,EP,ES,  
FI,GB,GD,GE,GH,GM,HR,HU,ID,IL,IN,IS,JP,KE,KG,KZ,LC,LK,LR,LS,LT,LU,LV,MA,MD,MG,MK,  
MN,MW,MX,MZ,NO,NZ,OA,PL,PT,RO,RU,SD,SE,SG,SI,SK,SL,TJ,TM,TR,TT,TZ,UA,UG,UZ,VN,YU,  
The communication will be made to those Offices only upon their request. Furthermore, those Offices do not require the applicant to furnish a copy of the international application (Rule 49.1(a-bis)).

3. Enclosed with this Notice is a copy of the international application as published by the International Bureau on  
01 March 2001 (01.03.01) under No. WO 01/14606

**REMINDER REGARDING CHAPTER II (Article 31(2)(a) and Rule 54.2)**

If the applicant wishes to postpone entry into the national phase until 30 months (or later in some Offices) from the priority date, a demand for international preliminary examination must be filed with the competent International Preliminary Examining Authority before the expiration of 19 months from the priority date.

It is the applicant's sole responsibility to monitor the 19-month time limit.

Note that only an applicant who is a national or resident of a PCT Contracting State which is bound by Chapter II has the right to file a demand for international preliminary examination.

**REMINDER REGARDING ENTRY INTO THE NATIONAL PHASE (Article 22 or 39(1))**

If the applicant wishes to proceed with the international application in the national phase, he must, within 20 months or 30 months, or later in some Offices, perform the acts referred to therein before each designated or elected Office.

For further important information on the time limits and acts to be performed for entering the national phase, see the Annex to Form PCT/IB/301 (Notification of Receipt of Record Copy) and Volume II of the PCT Applicant's Guide.

The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland	Authorized officer  J. Zahra
Facsimile No. (41-22) 740.14.35	Telephone No. (41-22) 338.83.38

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(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization  
International Bureau



(43) International Publication Date  
1 March 2001 (01.03.2001)

PCT

(10) International Publication Number  
**WO 01/14606 A1**

- (51) International Patent Classification<sup>7</sup>: C22C 9/04 (74) Agent: SIEBMANN, H.; Gotapatent AB, Box 154, S-561 22 Huskvarna (SE).
- (21) International Application Number: PCT/SE00/01589 (81) Designated States (*national*): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CR, CU, CZ, DE, DK, DM, DZ, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW.
- (22) International Filing Date: 18 August 2000 (18.08.2000)
- (25) Filing Language: Swedish
- (26) Publication Language: English
- (30) Priority Data:  
9903003-3 26 August 1999 (26.08.1999) SE (84) Designated States (*regional*): ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).
- (71) Applicant (*for all designated States except US*): TOUR & ANDERSSON HYDRONICS AB [SE/SE]; S-524 80 Ljung (SE).
- (72) Inventors; and
- (75) Inventors/Applicants (*for US only*): DÄCKER, Carl-Åke [SE/SE]; Gröna Vägen 52A, S-541 54 Skövde (SE). LANGELOTZ, Ulla [SE/SE]; Backvägen 6, S-513 32 Fristad (SE).

**Published:**

— With international search report.

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: DIE-CASTING BRASS ALLOY WHICH IS RESISTANT TO DEZINCIFICATION

(57) Abstract: The present invention relates to a die-casting brass alloy having a dezincification resistance, which is lower than 100 µm for a separate value according to British Standard BS 2872 in a die-casting condition (i.e. without a subsequent phase transforming heat treatment). The alloy according to the invention is characterized by the following composition: Cu: 63,6 weight-%; Pb: 1,8 weight-%; Si: 0,73 weight-%; Al: 0,07 weight-%; As: 0,06 weight-%; Ni: 0,2 weight-%; Sn: 0,3 weight-%; Fe: 0,25 weight-%; B: 8 ppm. Other impurities: max.0,3 weight-%, Zn: remainder.

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# DIE-CASTING BRASS ALLOY WHICH IS RESISTANT TO DEZINCIFICATION

The present invention relates to a die-casting brass alloy, which is resistant to dezincification according to the preamble of claim 1.

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Dezincification is a problem for brass water fittings, when the water quality varies and maybe is strongly corrosive.

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It is known, that it is possible to treat the copper rich alpha-phase in brass against dezincification by means of small additions of arsenic or antimony, whereas the zinc rich beta-phase is not resistant to dezincification.

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Thus, it would be logical to keep a high percentage of copper in a brass alloy resistant to dezincification (as an alloy 1 in Fig. 1, showing a portion of the phase diagram Cu-Zn, Hansen, Constitution of binary alloys, New York 1958) in order to minimize or completely avoid the amount of the less corrosive resistant beta-phase. The problem with such an alloy is, that it results in a primary solidification of the alpha-phase in the form of long solidification crystals, so called dendrites, which means, that the beta-phase will form long bands between the alpha-dendrites. This results in two negative consequences :

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a) The material will be brittle by heat ; and

b) The material will obtain a deep dezincification, since the dezincification will follow the long beta-phase bands.

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This phenomenon is thoroughly described in the following scientific article: Arno Louvo, Tapio Rantala, Veijo Tauta, "The Effect of Composition on as-cast Microstructure of alfa/beta-Brass and its Control by Microcomputer", LISBOA 84, 51 st International Foundry Congress.

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Fig. 2, which has been excerpted from this article, describes the problem with brittleness by heat, and Fig. 3, which has been excerpted from the same article, the phenomenon with increasing dezincification depths with an increasing copper content.

In order to avoid the above-mentioned problems the alloy must solidify primarily in the beta-phase as an alloy 2 in Fig. 1, which allows the following advantages :

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a) The amounts of micro and macro segregations will be substantially lower for an alloy, which solidifies primarily in the beta-phase. This is caused by the fact, that the diffusion speed in the beta-phase is about 1000 times higher than in the alpha-phase, which is a result of the fact, that its crystal structure has an atom arrangement according to bcc (body-centered-cubic) as compared to the atom arrangement of the alpha-phase fcc (face-centered-cubic).

b) The solidification crystals may be fine grain-treated with boron, which forms fine grains in a very efficient way, and only extremely small amounts of this substance is needed to obtain a fine grain-forming effect. According to experience boron does not have a fine grain-forming effect on brass, which solidifies primarily in the alpha-phase, whereas it is very efficient as far as nucleation of beta-crystals is concerned.

The drawback is, that the beta-phase amount increases in the final casting structure and without a heat treatment it will be difficult to meet the toughest dezincification requirements according to BS 2872, which requires a maximal dezincification depth of 100  $\mu\text{m}$  as a separate value. This is true above all for heavy thicknesses of material, shown in Fig. 3.

The information above are known basic facts.

Additional already known techniques are described in WO 89/08725 A1, EP 0 572 959 A1 and MNC manual no. 8, edition 2, September 1987, "Specialmässing", page 43.

The object of the present invention is to suggest a way of eliminating the above-mentioned drawbacks.

This object is attained according to the invention by the development of an alloy having the following characteristics.

By balancing copper, zinc, silicon and aluminum in a capable manner it is possible to attain a solidification in the beta-phase and nevertheless avoid the development of continuous beta-phase areas in the finished product. The beta-phase will be found in isolated agglomerates in a matrix of alpha-phase, which is protected against a dezincification due to the arsenic addition. The primary solidification in the beta-phase with the alloy combination according to the invention combined with the high solidification speed of the die-casting limits the size of the agglomerates of the beta-phase in the final casting structure, the agglomerates also in a thick die-casting material with a low solidification speed obtaining an extension, which is clearly less than 100  $\mu\text{m}$ . By means of fine



grain-treatment with boron the size of the agglomerates and consequently also the depth of the dezincification can be additionally reduced.'

These conclusions have been confirmed by the results of an extensive development effort during several years, the purpose of which has been to find appropriate alloy combinations. This is shown in the following drawings :

Fig. 4 shows, how the amount of peritectically solidifying materials (solidification primarily in the alpha-phase) quickly is reduced, when the copper content in the alloy is reduced, whereas the increase of the amount in the beta-phase in the final structure increases relatively slowly.

Fig. 5 shows the result from investigations of the dezincification depth according to the international standard ISO 6509 for die-cast work pieces having a 6 mm thickness of material as to alloys having a varying Cu content. The result is unambiguous. A dezincification minimum is attained exactly in the area, where the peritectic solidification ceases, at the same time as the amount of beta-phase has not yet become too large. The figure shows a dezincification depth for a maximal separate value as well as median values for a number of measurements, done on the same test object. The result is , that in a relatively wide area the obtained result falls below the requirements regarding the dezincification resistance according to BS 2872 of maximally 100  $\mu\text{m}$  for a separate value.

The object of the invention is to suggest an alloy , which also meets the dezincification requirements for thick die-cast materials, and Fig. 6 shows the result for the corresponding investigation with a material thickness of 16 mm. Also for this material thickness the requirement is met, namely maximally 100  $\mu\text{m}$  for a separate value but within a more narrow interval.

- At a Cu content of lower than 63.6 % the beta-phase agglomerates become so large, that they start to grow together, which results in a too large dezincification.

- At a Cu content of higher than 64.1 % the amount of primary solidification in the alpha-phase becomes so large, that long beta-phase bands develop between the alpha crystals and consequently a deep dezincification is obtained.

The positive results of this balancing of the alloy ingredients are summarized as follows :

1) Die-cast material, made of the alloy, meet, without a subsequent heat treatment, the requirements according to BS 2872 as to a maximal dezincification depth of 100  $\mu\text{m}$  for a separate value

2) The alloy can be fine grain-treated with boron in an efficient way, which results in a most fine-grained structure in the finished product, which results in two advantages :

- The dezincification resistance is further improved, because the size of the beta-phase agglomerates is further reduced ; and

- The porosity in the die-cast material is distributed more evenly and the separate size becomes smaller, which reduces the risk of a leaky die-cast material and consequently the rejection costs for products, which must meet pressure impenetrability requirements, are also reduced.

3) The aluminum content can be kept at a low level, 0.03 – 0.1 weight-%, which means, that the positive effect of the aluminum addition on a die-casting alloy is utilized, but the negative effects are avoided.

- Positive effects include the strong dezincification effect of aluminum, which means, that also at a low aluminum content the oxygen content in the melt is stable and very low. Aluminum exerts also in small amounts a purification effect in such a way, that it reduces a zinc oxide coating on pouring cups, molding tools and cores ; and

- Negative effects include the formation in alloys , which include silicon and in which the aluminum content is larger than 0.1 weight-%, of a sticky slag, which consists of aluminum silicates. When a melt is applied with a cup, a portion of this slag will be introduced into the product, in which it forms "hazes" and "balls". These inclusions impair the mechanical properties of the finished product, but, what is worse, they function as capillaries, which means, that the dezincification follows the inclusions, if they reach the surface, which results in deep dezincifications, which by far goes beyond the requirements regarding the dezincification resistance according to BS 2872 of a maximally 100  $\mu\text{m}$  dezincification for a separate value.

In this respect the present invention differs from the fine grain-treated alloy according to DE-A 43 18 377 A1, which recommends an aluminum content of 0.3-0.7 weight-% and a silicon content of 0. -0.7 weight-%.

A dezincification resistant alloy according to the present invention is characterized by the following compositions :

Cu:	63,0-65,5	weight-%
Pb:	1,5-2,2	weight-%
Si:	0,6-0,9	weight-%

	Al:	0,03-0,1	weight-%
	As:	0,03-0,1	weight-%
	Ni:	max 0,5	weight-%
	Sn:	max 0,5	weight-%
5	Fe:	0,1-0,5	weight-%
	B:	0-15	ppm
	Other impurities: max. 0.3 weight-%		
	Zn:	remainder	

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An example of a specified alloy, which has been produced for quite a long time on a large scale, has turned out to meet the requirements according to the invention quite well:

	Cu:	63,6	weight-%
15	Pb:	1,8	weight-%
	Si:	0,73	weight-%
	Al:	0,07	weight-%
	As:	0,06	weight-%
	Ni:	0,2	weight-%
20	Sn:	0,3	weight-%
	Fe:	0,25	weight-%
	B:	8	ppm
	Other impurities : max. 0.3 weight-%		
	Zn:	remainder	

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The invention is not limited to the preferred embodiments specified above, but it can be modified and supplemented in an arbitrary fashion within the scope of the inventive idea and the following claims. This is particularly true, as regards the lead content, since lead is not dissolved in the alloy but remains as a separate phase, which does not influence the dezincification resistance. This means, that, if the lead content is reduced to below the specified interval, the rest of the alloy elements must be adjusted stoichiometrically.

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**CLAIMS**

1. A die-casting brass alloy having a dezincification resistance, which is lower than 100  $\mu\text{m}$  for a separate value according to British Standard BS 2872 in a die-casting condition (i.e. without a subsequent phase transforming heat treatment), **c h a r a c t e r i z e d** by the following composition:

	Cu:	63,0-65,0	weight-%
	Pb:	1,5-2,2	weight-%
10	Si:	0,6-0,9	weight-%
	Al:	0,03-0,1	weight-%
	As:	0,03-0,1	weight-%
	Ni:	max 0,5	weight-%
	Sn:	max 0,5	weight-%
15	Fe:	0,1-0,5	weight-%
	B:	0-15 ppm	
	Other impurities: max 0,3 weight-%		
	Zn:	remainder	

- 20 2. A die-casting brass alloy according to claim 1 having a dezincification resistance, which is lower than 100  $\mu\text{m}$  for a separate value according to British Standard BS 2872 in a die-casting condition (i.e. without a subsequent phase transforming heat treatment), **c h a r a c t e r i z e d** by the following composition:

	Cu:	63,6	weight-%
25	Pb:	1,8	weight-%
	Si:	0,73	weight-%
	Al:	0,07	weight-%
	As:	0,06	weight-%
	Ni:	0,2	weight-%
30	Sn:	0,3	weight-%
	Fe:	0,25	weight-%
	B:	8 ppm	
	Other impurities: max. 0,3 weight-%		
	Zn:	remainder	

## ABSTRACT OF THE DISCLOSURE

The present invention relates to a die-casting brass alloy having a dezincification resistance, which is lower than 100  $\mu\text{m}$  for a separate value according to British Standard BS 2872 in a die-casting condition (i.e. without a subsequent phase transforming heat treatment). The alloy according to the invention is characterized by the following composition :

Cu: 63,6 weight-%

Pb: 1,8 weight-%

Si: 0,73 weight-%

Al: 0,07 weight-%

As: 0,06 weight-%

Ni: 0,2 weight-%

Sn: 0,3 weight-%

Fe: 0,25 weight-%

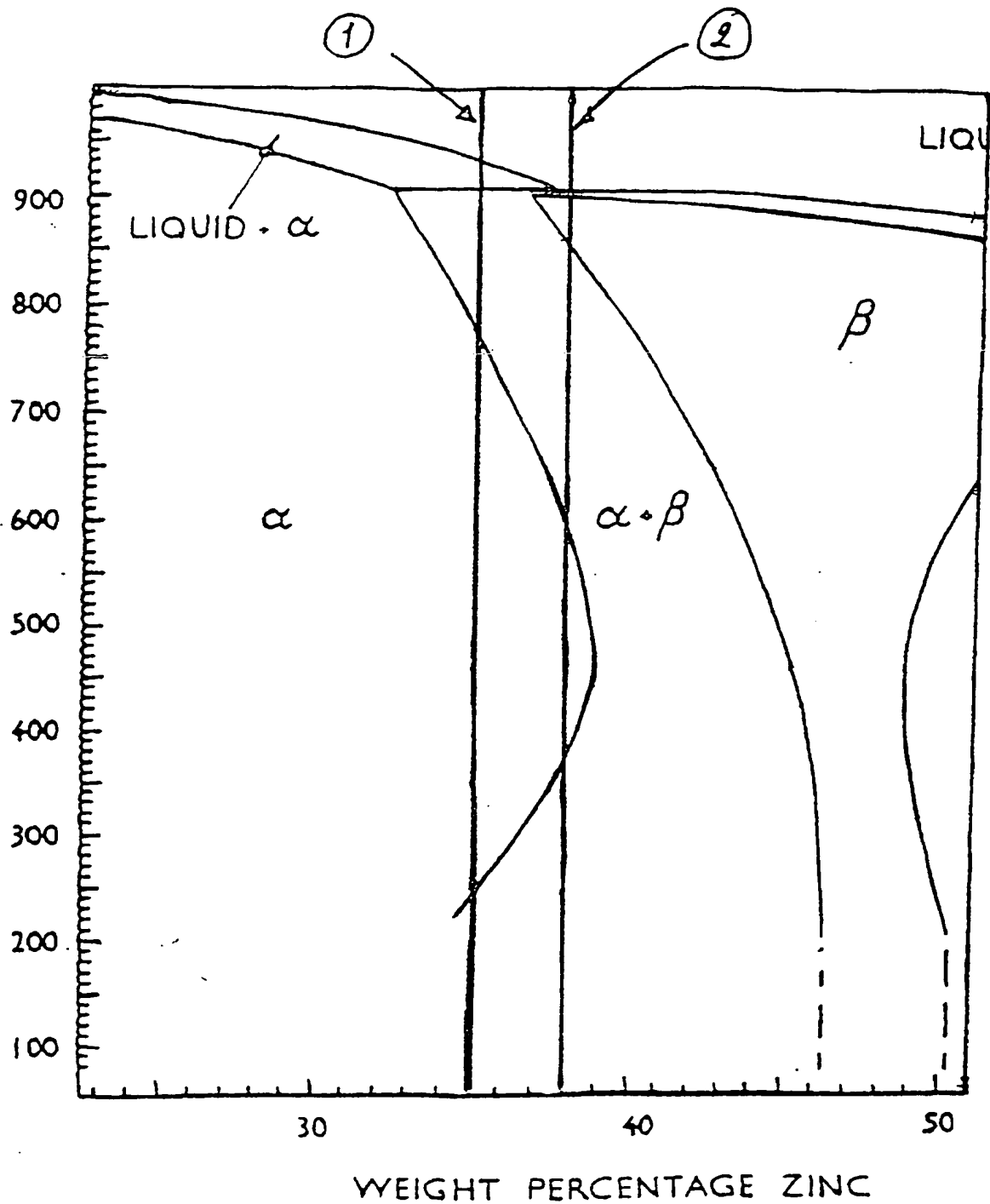
B: 8 ppm

Other impurities: max. 0,3 weight-%

Zn: remainder.

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FIG 1



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Hot-learing tendencies and the binary  
copper-zinc phase diagram

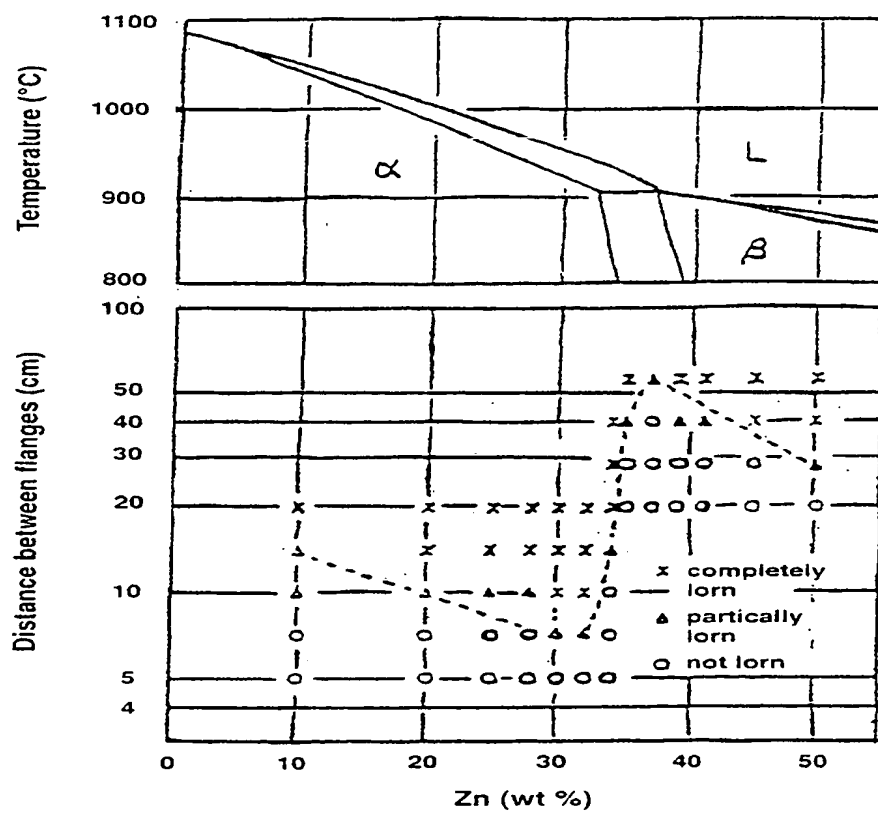


FIG 2

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The result of the dezincification tests.

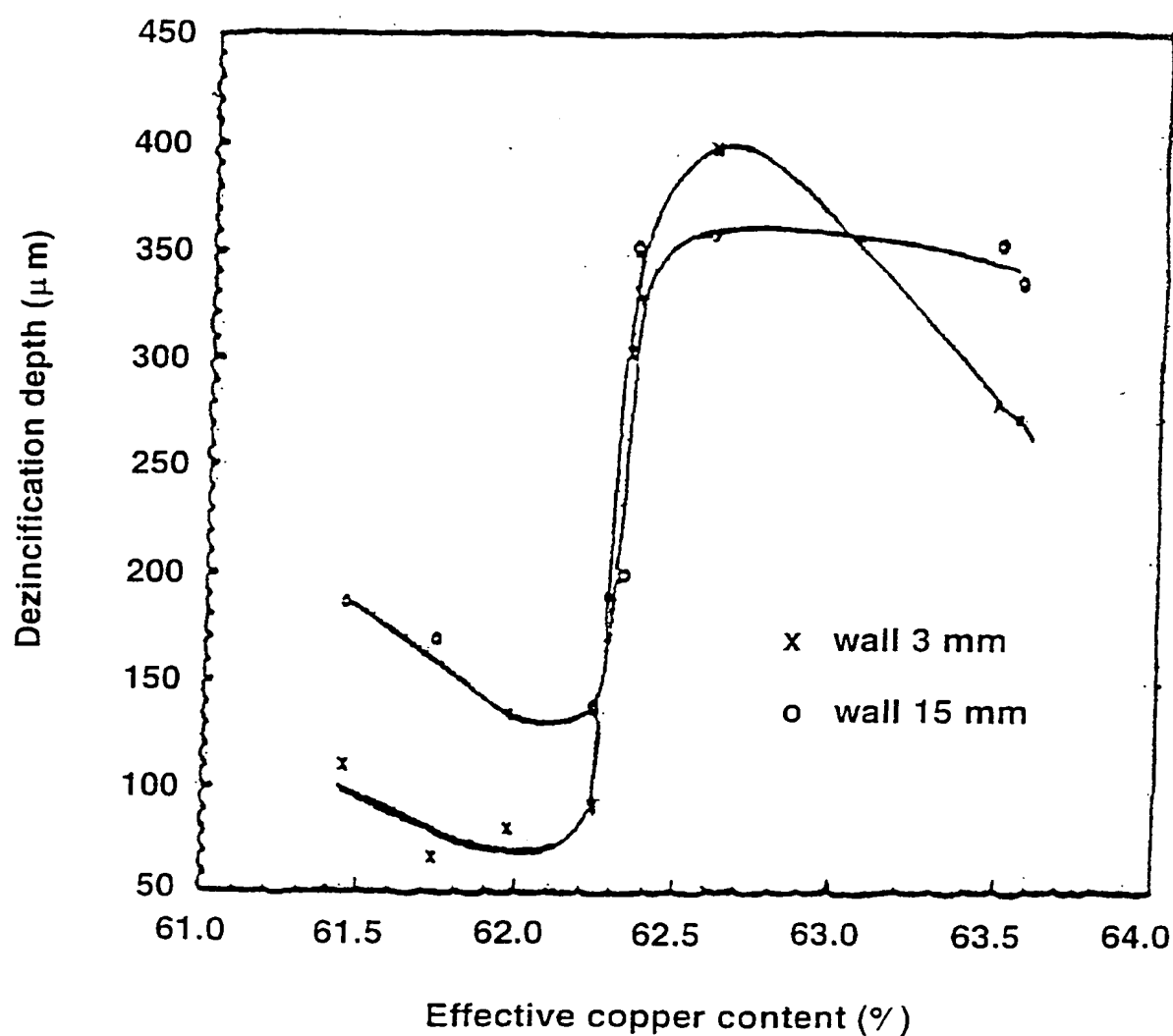
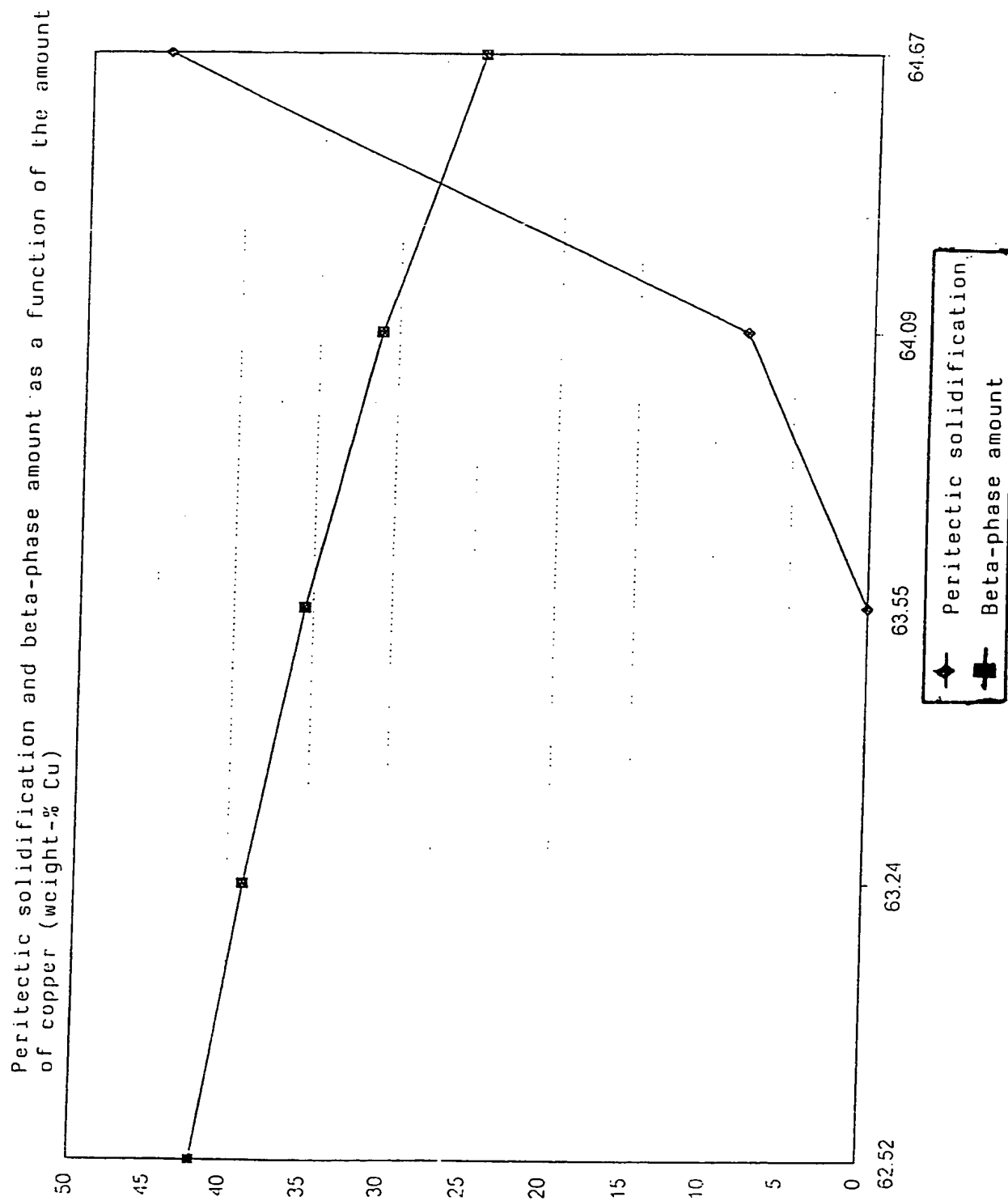


FIG 3

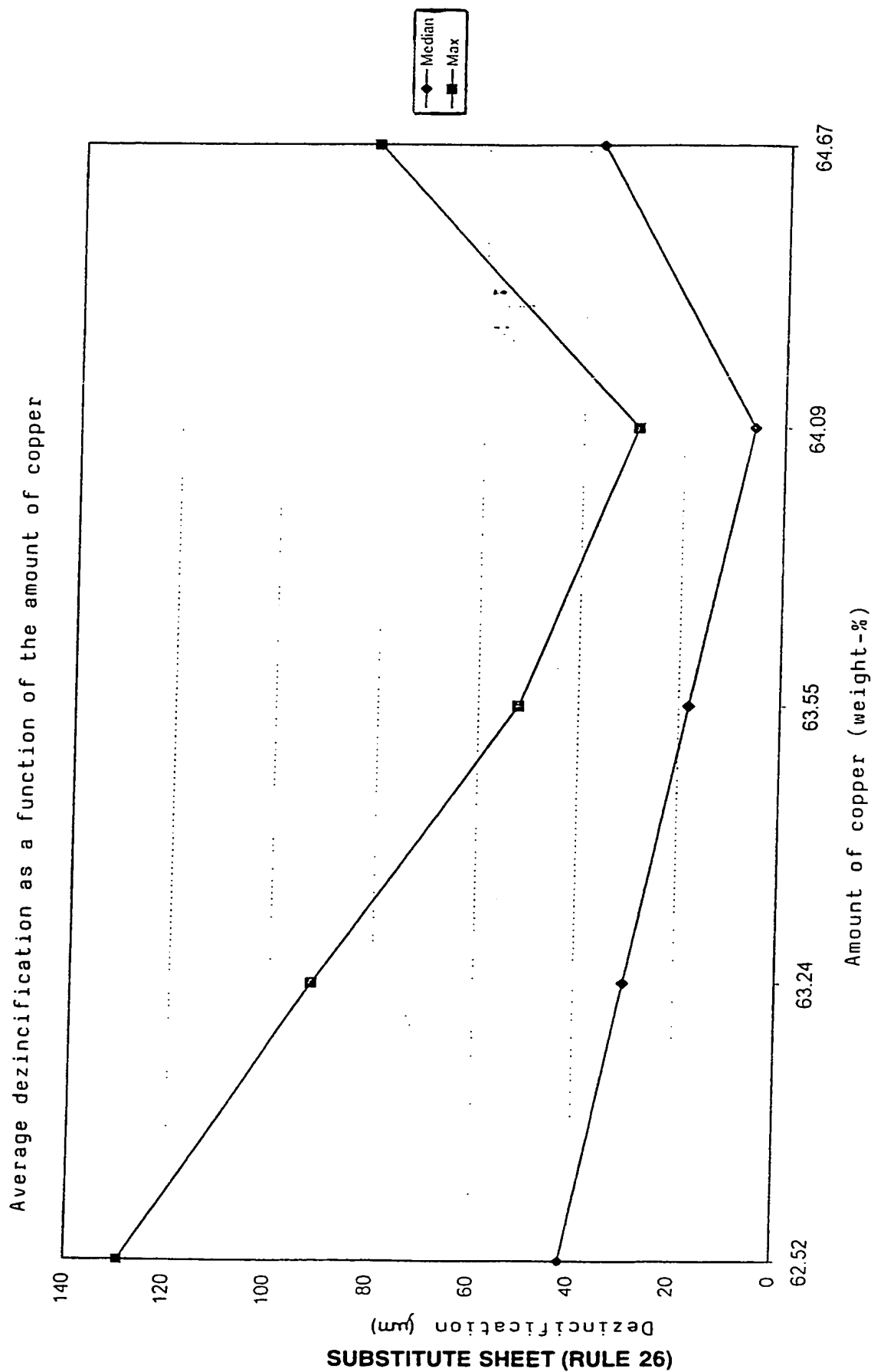
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FIG 4



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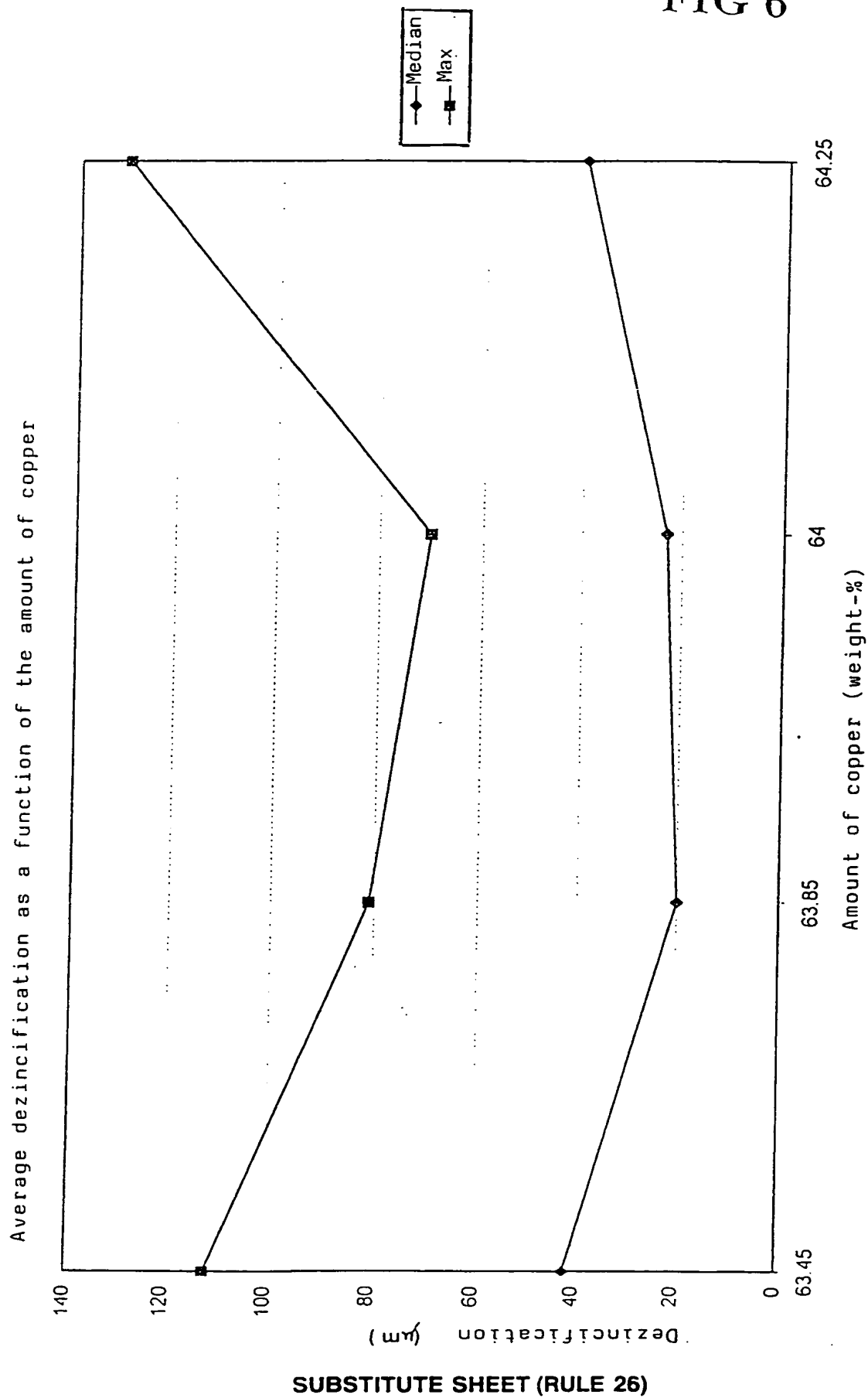
FIG 5



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FIG 6



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## INTERNATIONAL SEARCH REPORT

International application No.

PCT/SE 00/01589

## A. CLASSIFICATION OF SUBJECT MATTER

IPC7: C22C 9/04

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: C22C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 8908725 A1 (TOUR & ANDERSSON AB), 21 Sept 1989 (21.09.89), page 8, line 7 - line 19, abstract	1
A	--	2
A	EP 0572959 A1 (HETZEL & CO ET AL), 8 December 1993 (08.12.93), abstract	1-2
A	--	
A	MNC handbok, Volume, No 8, Sept 1987, Metallnormcentralen, "Koppar och kopparlegeringar", "specialmässing sidan 43"	1-2
	--	



Further documents are listed in the continuation of Box C.



See patent family annex.

\* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"I" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&amp;" document member of the same patent family

Date of the actual completion of the international search

28 November 2000

Date of mailing of the international search report

06 -12- 2000

Name and mailing address of the ISA

Swedish Patent Office

Box 5055, S-102 42 STOCKHOLM

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## INTERNATIONAL SEARCH REPORT

International application No.

PCT/SE 00/01589

## C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	<p>JP 58181839 A (YAMAMOTO SANGYO KK) 1983-10-24            (abstract) World Patents Index (online). London,            U.K.: Derwent Publications, Ltd. (retrieved on            2000-11-28). Retrieved from: EPO WPI Database.            DW 198348, Accession No. 1983-830567            &amp; JP 58181839 A (YAMAMOTO SANGYO KK) 1984-01-21            (abstract) (online) (retrieved on 2000-11-28).            Retrieved from EPO PAJ Database.</p> <p style="text-align: center;">--</p>	1-2
A	<p>JP 59118842 A (NIPPON MINING CO) 1984-07-09            (abstract) World Patents Index (online). London,            U.K.: Derwent Publications, Ltd. (retrieved on            2000-11-28). Retrieved from: EPO WPI Database.            DW 198433, Accession No. 1984-205053            &amp; JP 59118842 A (NIPPON KOGYO KK) 1984-10-30            (abstract) (online) (retrieved on 2000-11-28)            Retrieved from: EPO PAJ Database.</p> <p style="text-align: center;">--            -----</p>	1-2

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**INTERNATIONAL SEARCH REPORT**  
Information on patent family members

02/11/00

International application No.  
PCT/SE 00/01589

Patent document cited in search report			Publication date	Patent family member(s)			Publication date
WO	8908725	A1	21/09/89	AU	3437289	A	05/10/89
				SE	8800931	D	00/00/00
<hr/>							
EP	0572959	A1	08/12/93	SE	0572959	T3	
				AT	149042	T	15/03/97
				AU	664092	B	02/11/95
				AU	4000493	A	09/12/93
				DE	4318377	A,C	16/12/93
				DE	59305476	D	00/00/00
				ES	2099863	T	01/06/97
<hr/>							

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REC'D 07 DEC 2001

## INTERNATIONAL PRELIMINARY EXAMINATION REPORT PCT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference T022-316/PC	<b>FOR FURTHER ACTION</b> See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)	
International application No. PCT/SE00/01589	International filing date (day/month/year) 18.08.2000	Priority date (day/month/year) 26.08.1999
International Patent Classification (IPC) or national classification and IPC <sup>7</sup> C22C 9/04		
Applicant Tour & Andersson Hydronics AB et al		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.
2. This REPORT consists of a total of 3 sheets, including this cover sheet.
- ☐ This report is also accompanied by ANNEXES, i.e., sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

These annexes consist of a total of \_\_\_\_\_ sheets.

3. This report contains indications relating to the following items:

- I ☒ Basis of the report
- II ☐ Priority
- III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- IV ☐ Lack of unity of invention
- V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- VI ☐ Certain documents cited
- VII ☐ Certain defects in the international application
- VIII ☐ Certain observations on the international application

Date of submission of the demand  09.02.2001	Date of completion of this report  26.11.2001
Name and mailing address of the IPEA/SE Patent- och registreringsverket Box 5055 S-102 42 STOCKHOLM Facsimile No. 08-667 72 88	Authorized officer  Ulrika Nilsson/MP Telephone No. 08-782 25 00

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**I. Basis of the report****1. With regard to the elements of the international application:\***

- ☒ the international application as originally filed
- ☐ the description:  
pages \_\_\_\_\_, as originally filed  
pages \_\_\_\_\_, filed with the demand  
pages \_\_\_\_\_, filed with the letter of \_\_\_\_\_
- ☐ the claims:  
pages \_\_\_\_\_, as originally filed  
pages \_\_\_\_\_, as amended (together with any statement) under article 19  
pages \_\_\_\_\_, filed with the demand  
pages \_\_\_\_\_, filed with the letter of \_\_\_\_\_
- ☐ the drawings:  
pages \_\_\_\_\_, as originally filed  
pages \_\_\_\_\_, filed with the demand  
pages \_\_\_\_\_, filed with the letter of \_\_\_\_\_
- ☐ the sequence listing part of the description:  
pages \_\_\_\_\_, as originally filed  
pages \_\_\_\_\_, filed with the demand  
pages \_\_\_\_\_, filed with the letter of \_\_\_\_\_

**2. With regard to the language, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.**

These elements were available or furnished to this Authority in the following language English which is:

- ☐ the language of a translation furnished for the purposes of international search (under Rule 23.1(b)).
- ☒ the language of publication of the international application (under Rule 48.3(b)).
- ☐ the language of the translation furnished for the purposes of international preliminary examination (under Rules 55.2 and/or 55.3).

**3. With regard to any nucleotide and/or amino acid sequence disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:**

- ☐ contained in the international application in written form.
- ☐ filed together with the international application in computer readable form.
- ☐ furnished subsequently to this Authority in written form.
- ☐ furnished subsequently to this Authority in computer readable form.
- ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

**4. ☐ The amendments have resulted in the cancellation of:**

- ☐ the description, pages \_\_\_\_\_
- ☐ the claims. Nos. \_\_\_\_\_
- ☐ the drawings, sheet/fig \_\_\_\_\_

**5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2 (c)).\*\***

\* Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are annexed to this report since they do not contain amendments (Rules 70.16 and 70.17).

\*\* Any replacement sheet containing such amendments must be referred to under item I and annexed to this report.

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**V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement****1. Statement**

Novelty (N)	Claims	<u>1-2</u>	YES
	Claims		NO
Inventive step (IS)	Claims	<u>2</u>	YES
	Claims	<u>1</u>	NO
Industrial applicability (IA)	Claims	<u>1-2</u>	YES
	Claims		NO

**2. Citations and explanations (Rule 70.7)**

The following documents are cited in the International Search Report:

D1: WO 8908725 A1 (Tour & Andersson AB)  
D2: EP 0572959 A1 (Hetzel & Co et al.)  
D3: MNC handbok, Volume No 8, Sept. 1987, Metallnormcentralen, "Koppar och kopparlegeringar, "specialmässing page 43"  
D4: JP 58 181 839 A (Yamamoto Sangyo KK)  
D5: JP 59 118842 A (Nippon Mining Co)

D1 reveals a die-casting brass alloy with resistance to dezincification (refer to example 5). The claimed alloy differs from this known alloy by the presence of arsenic and boron. However, it is common knowledge to fine-grain treat brass by adding boron (refer to D2 page 2 line 30) and also to prevent dezincification by adding arsenic (refer to D1 and D3 page 43). Therefore, adding these substances to the alloy claimed in claim 1, in order to achieve these effects, is considered obvious to a person skilled in the art.

In view of the arguments stated above, the invention according to claim 1 is novel but is not considered to involve an inventive step. The invention according to claim 2 is novel and is considered to involve an inventive step. As well, the invention according to claims 1-2 fulfils the criterion of industrial applicability.

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# PATENT COOPERATION TREATY

# PCT

## INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference T022-316/PC	<b>FOR FURTHER ACTION</b> See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)	
International application No. PCT/SE00/01589	International filing date ( <i>day/month/year</i> ) 18.08.2000	Priority date ( <i>day/month/year</i> ) 26.08.1999
International Patent Classification (IPC) or national classification and IPC <sub>7</sub> C22C 9/04		
Applicant Tour & Andersson Hydronics AB et al		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 3 sheets, including this cover sheet.

☐ This report is also accompanied by ANNEXES, i.e., sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

These annexes consist of a total of \_\_\_\_\_ sheets.

3. This report contains indications relating to the following items:

- I ☒ Basis of the report
- II ☐ Priority
- III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- IV ☐ Lack of unity of invention
- V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- VI ☐ Certain documents cited
- VII ☐ Certain defects in the international application
- VIII ☐ Certain observations on the international application

Date of submission of the demand  09.02.2001	Date of completion of this report  26.11.2001
Name and mailing address of the IPEA/SE Patent- och registreringsverket Box 5055 S-102 42 STOCKHOLM Facsimile No. 08-667 72 88	Authorized officer  Ulrika Nilsson/MP Telephone No. 08-782 25 00

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**I. Basis of the report****1. With regard to the elements of the international application:\***☒ the international application as originally filed☐ the description:

pages \_\_\_\_\_, as originally filed

pages \_\_\_\_\_, filed with the demand

pages \_\_\_\_\_, filed with the letter of \_\_\_\_\_

☐ the claims:

pages \_\_\_\_\_, as originally filed

pages \_\_\_\_\_, as amended (together with any statement) under article 19

pages \_\_\_\_\_, filed with the demand

pages \_\_\_\_\_, filed with the letter of \_\_\_\_\_

☐ the drawings:

pages \_\_\_\_\_, as originally filed

pages \_\_\_\_\_, filed with the demand

pages \_\_\_\_\_, filed with the letter of \_\_\_\_\_

☐ the sequence listing part of the description:

pages \_\_\_\_\_, as originally filed

pages \_\_\_\_\_, filed with the demand

pages \_\_\_\_\_, filed with the letter of \_\_\_\_\_

**2. With regard to the language, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.**These elements were available or furnished to this Authority in the following language English which is:☐ the language of a translation furnished for the purposes of international search (under Rule 23.1(b)).☒ the language of publication of the international application (under Rule 48.3(b)).☐ the language of the translation furnished for the purposes of international preliminary examination (under Rules 55.2 and/or 55.3).**3. With regard to any nucleotide and/or amino acid sequence disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:**☐ contained in the international application in written form.☐ filed together with the international application in computer readable form.☐ furnished subsequently to this Authority in written form.☐ furnished subsequently to this Authority in computer readable form.☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.**4. ☐ The amendments have resulted in the cancellation of:**☐ the description, pages \_\_\_\_\_☐ the claims, Nos. \_\_\_\_\_☐ the drawings, sheet/fig \_\_\_\_\_**5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2 (c)).\*\***

\* Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are annexed to this report since they do not contain amendments (Rules 70.16 and 70.17).

\*\* Any replacement sheet containing such amendments must be referred to under item I and annexed to this report.

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**V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement****1. Statement**

Novelty (N)	Claims	<u>1-2</u>	YES
	Claims		NO
Inventive step (IS)	Claims	<u>2</u>	YES
	Claims	<u>1</u>	NO
Industrial applicability (IA)	Claims	<u>1-2</u>	YES
	Claims		NO

**2. Citations and explanations (Rule 70.7)**

The following documents are cited in the International Search Report:

D1: WO 8908725 A1 (Tour & Andersson AB)  
D2: EP 0572959 A1 (Hetzel & Co et al.)  
D3: MNC handbok, Volume No 8, Sept. 1987, Metallnormcentralen, "Koppar och kopparlegeringar, "specialmässing page 43"  
D4: JP 58 181 839 A (Yamamoto Sangyo KK)  
D5: JP 59 118842 A (Nippon Mining Co)

D1 reveals a die-casting brass alloy with resistance to dezincification (refer to example 5). The claimed alloy differs from this known alloy by the presence of arsenic and boron. However, it is common knowledge to fine-grain treat brass by adding boron (refer to D2 page 2 line 30) and also to prevent dezincification by adding arsenic (refer to D1 and D3 page 43). Therefore, adding these substances to the alloy claimed in claim 1, in order to achieve these effects, is considered obvious to a person skilled in the art.

In view of the arguments stated above, the invention according to claim 1 is novel but is not considered to involve an inventive step. The invention according to claim 2 is novel and is considered to involve an inventive step. As well, the invention according to claims 1-2 fulfils the criterion of industrial applicability.

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# PATENT COOPERATION TREATY

## PCT

### INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference <b>T022-316/PC</b>	<b>FOR FURTHER ACTION</b>	see Notification of Transmittal of International Search Report <sup>1</sup> (Form PCT/ISA/220) as well as, where applicable, item 5 below.
International application No. <b>PCT/SE 00/01589</b>	International filing date ( <i>day/month/year</i> ) <b>18 August 2000</b>	(Earliest) Priority Date ( <i>day/month/year</i> ) <b>26 August 1999</b>
Applicant <b>Tour &amp; Andersson Hydronics AB et al</b>		

This international search report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This international search report consists of a total of 3 sheets.

☒ It is also accompanied by a copy of each prior art document cited in this report.

**1. Basis of the report**

a. With regard to the language, the international search was carried out on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.

☒ the international search was carried out on the basis of a translation of the international application furnished to this Authority (Rule 23.1(b)).

b. With regard to any nucleotide and/or amino acid sequence disclosed in the international application, the international search was carried out on the basis of the sequence listing:

☐ contained in the international application in written form.

☐ filed together with the international application in computer readable form.

☐ furnished subsequently to this Authority in written form.

☐ furnished subsequently to this Authority in computer readable form.

☐ the statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.

☐ the statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

2. ☐ Certain claims were found unsearchable (See Box I).

3. ☐ Unity of invention is lacking (See Box II).

4. With regard to the title,

☒ the text is approved as submitted by the applicant.

☐ the text has been established by this Authority to read as follows:

5. With regard to the abstract,

☒ the text is approved as submitted by the applicant.

☐ the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box III. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. The figure of the drawings to be published with the abstract is Figure No. \_\_\_\_\_

☐ as suggested by the applicant.

☐ because the applicant failed to suggest a figure.

☐ because this figure better characterizes the invention.

☒ None of the figures.

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## INTERNATIONAL SEARCH REPORT

International application No.

PCT/SE 00/01589

## A. CLASSIFICATION OF SUBJECT MATTER

IPC7: C22C 9/04

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: C22C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 8908725 A1 (TOUR & ANDERSSON AB), 21 Sept 1989 (21.09.89), page 8, line 7 - line 19, abstract	1
A	--	2
A	EP 0572959 A1 (HETZEL & CO ET AL), 8 December 1993 (08.12.93), abstract	1-2
A	MNC handbok, Volume, No 8, Sept 1987, Metallnormcentralen, "Koppar och kopparlegeringar", "specialmässing sidan 43"	1-2
	--	

☒ Further documents are listed in the continuation of Box C.☒ See patent family annex.

\* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

Date of mailing of the international search report

28 November 2000

06 -12- 2000

Name and mailing address of the ISA/  
Swedish Patent Office  
Box 5055, S-102 42 STOCKHOLM  
Facsimile No. +46 8 666 02 86

Authorized officer

Ulrika Nilsson/MP  
Telephone No. +46 8 782 25 00

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## C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	<p>JP 58181839 A (YAMAMOTO SANGYO KK) 1983-10-24            (abstract) World Patents Index (online). London,            U.K.: Derwent Publications, Ltd. (retrieved on            2000-11-28). Retrieved from: EPO WPI Database.            DW 198348, Accession No. 1983-830567            &amp; JP 58181839 A (YAMAMOTO SANGYO KK) 1984-01-21            (abstract) (online) (retrieved on 2000-11-28).            Retrieved from EPO PAJ Database.</p> <p style="text-align: center;">--</p>	1-2
A	<p>JP 59118842 A (NIPPON MINING CO) 1984-07-09            (abstract) World Patents Index (online). London,            U.K.: Derwent Publications, Ltd. (retrieved on            2000-11-28). Retrieved from: EPO WPI Database.            DW 198433, Accession No. 1984-205053            &amp; JP 59118842 A (NIPPON KOGYO KK) 1984-10-30            (abstract) (online) (retrieved on 2000-11-28)            Retrieved from: EPO PAJ Database.</p> <p style="text-align: center;">--            -----</p>	1-2

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**INTERNATIONAL SEARCH REPORT**  
Information on patent family members

International application No.  
02/11/00 PCT/SE 00/01589

Patent document cited in search report			Publication date	Patent family member(s)			Publication date
WO	8908725	A1	21/09/89	AU	3437289	A	05/10/89
				SE	8800931	D	00/00/00
<hr/>							
EP	0572959	A1	08/12/93	SE	0572959	T3	
				AT	149042	T	15/03/97
				AU	664092	B	02/11/95
				AU	4000493	A	09/12/93
				DE	4318377	A,C	16/12/93
				DE	59305476	D	00/00/00
				ES	2099863	T	01/06/97
<hr/>							

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pp 18.840 000821

PCT

# REQUEST

The undersigned requests that the present international application be processed according to the Patent Cooperation Treaty.

For receiving Office use only

International Application No.

International Filing Date

10/0694 67

Name of receiving Office and "PCT International Application"

Applicant's or agent's file reference

(if desired) (12 characters maximum) T022-316/PC

**Box No. I TITLE OF INVENTION** Avzinkningsbeständig mässingslegering för pressgjutning - A die-casting brass alloy which is resistant to dezincification

## Box No. II APPLICANT

Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)

Tour & Andersson Hydronics AB

S-524 80 Ljung

☐ This person is also inventor.

Telephone No.

Facsimile No.

Teleprinter No.

State (that is, country) of nationality:  
Sweden

State (that is, country) of residence:  
Sweden

This person is applicant for the purposes of:

☐ all designated States

☒ all designated States except the United States of America

☐ the United States of America only

☐ the States indicated in the Supplemental Box

## Box No. III FURTHER APPLICANT(S) AND/OR (FURTHER) INVENTOR(S)

Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)

DÄCKER, Carl-Åke  
Gröna Vägen 52A  
S-541 54 Skövde

This person is:

☐ applicant only

☒ applicant and inventor

☐ inventor only (If this check-box is marked, do not fill in below.)

State (that is, country) of nationality:  
Sweden

State (that is, country) of residence:  
Sweden

This person is applicant for the purposes of:

☐ all designated States

☐ all designated States except the United States of America

☒ the United States of America only

☐ the States indicated in the Supplemental Box

☒ Further applicants and/or (further) inventors are indicated on a continuation sheet.

## Box No. IV AGENT OR COMMON REPRESENTATIVE; OR ADDRESS FOR CORRESPONDENCE

The person identified below is hereby/has been appointed to act on behalf of the applicant(s) before the competent International Authorities as:

☒ agent

☐ common representative

Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)

H. Siebmanns,  
GOTAPATENT AB  
Box 154  
S-561 22 Huskvarna  
Sweden

Telephone No.

+46-36-130211

Facsimile No.

+46-36-145126

Teleprinter No.

☐ Address for correspondence: Mark this check-box where no agent or common representative is/has been appointed and the space above is used instead to indicate a special address to which correspondence should be sent.

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## Continuation of Box No. III FURTHER APPLICANT(S) AND/OR (FURTHER) INVENTOR(S)

*If none of the following sub-boxes is used, this sheet should not be included in the request.*

Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)

LANGELÖTZ, Ulla  
Backvägen 6  
S-513 32 Fristad

This person is:

- ☐ applicant only  
☒ applicant and inventor  
☐ inventor only (If this check-box is marked, do not fill in below.)

State (that is, country) of nationality:  
Sweden

State (that is, country) of residence:  
Sweden

This person is applicant for the purposes of:

☐ all designated States

☐ all designated States except the United States of America

☒ the United States of America only

☐ the States indicated in the Supplemental Box

Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)

This person is:

- ☐ applicant only  
☐ applicant and inventor  
☐ inventor only (If this check-box is marked, do not fill in below.)

State (that is, country) of nationality:

State (that is, country) of residence:

This person is applicant for the purposes of:

☐ all designated States

☐ all designated States except the United States of America

☐ the United States of America only

☐ the States indicated in the Supplemental Box

Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)

This person is:

- ☐ applicant only  
☐ applicant and inventor  
☐ inventor only (If this check-box is marked, do not fill in below.)

State (that is, country) of nationality:

State (that is, country) of residence:

This person is applicant for the purposes of:

☐ all designated States

☐ all designated States except the United States of America

☐ the United States of America only

☐ the States indicated in the Supplemental Box

Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)

This person is:

- ☐ applicant only  
☐ applicant and inventor  
☐ inventor only (If this check-box is marked, do not fill in below.)

State (that is, country) of nationality:

State (that is, country) of residence:

This person is applicant for the purposes of:

☐ all designated States

☐ all designated States except the United States of America

☐ the United States of America only

☐ the States indicated in the Supplemental Box

☐ Further applicants and/or (further) inventors are indicated on another continuation sheet.

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## Box No.V DESIGNATION OF STATES

The following designations are hereby made under Rule 4.9(a) (mark the applicable check-box. At least one must be marked):

## Regional Patent

- ☒ AP ARIPO Patent: GH Ghana, GM Gambia, KE Kenya, LS Lesotho, MW Malawi, MZ Mozambique, SD Sudan, SL Sierra Leone, SZ Swaziland, TZ United Republic of Tanzania, UG Uganda, ZW Zimbabwe, and any other State which is a Contracting State of the Harare Protocol and of the PCT
- ☒ EA Eurasian Patent: AM Armenia, AZ Azerbaijan, BY Belarus, KG Kyrgyzstan, KZ Kazakhstan, MD Republic of Moldova, RU Russian Federation, TJ Tajikistan, TM Turkmenistan, and any other State which is a Contracting State of the Eurasian Patent Convention and of the PCT
- ☒ EP European Patent: AT Austria, BE Belgium, CH and LI Switzerland and Liechtenstein, CY Cyprus, DE Germany, DK Denmark, ES Spain, FI Finland, FR France, GB United Kingdom, GR Greece, IE Ireland, IT Italy, LU Luxembourg, MC Monaco, NL Netherlands, PT Portugal, SE Sweden, and any other State which is a Contracting State of the European Patent Convention and of the PCT
- ☒ OA OAPI Patent: BF Burkina Faso, BJ Benin, CF Central African Republic, CG Congo, CI Côte d'Ivoire, CM Cameroon, GA Gabon, GN Guinea, GW Guinea-Bissau, ML Mali, MR Mauritania, NE Niger, SN Senegal, TD Chad, TG Togo, and any other State which is a member State of OAPI and a Contracting State of the PCT (if other kind of protection or treatment desired, specify on dotted line)

## National Patent (if other kind of protection or treatment desired, specify on dotted line):

- |  |  |
|--|--|
| <input checked="" type="checkbox"/> AE United Arab Emirates                  | <input checked="" type="checkbox"/> LC Saint Lucia                               |
| <input checked="" type="checkbox"/> AG Antigua and Barbuda                   | <input checked="" type="checkbox"/> LK Sri Lanka                                 |
| <input checked="" type="checkbox"/> AL Albania                               | <input checked="" type="checkbox"/> LR Liberia                                   |
| <input checked="" type="checkbox"/> AM Armenia                               | <input checked="" type="checkbox"/> LS Lesotho                                   |
| <input checked="" type="checkbox"/> AT Austria                               | <input checked="" type="checkbox"/> LT Lithuania                                 |
| <input checked="" type="checkbox"/> AU Australia                             | <input checked="" type="checkbox"/> LU Luxembourg                                |
| <input checked="" type="checkbox"/> AZ Azerbaijan                            | <input checked="" type="checkbox"/> LV Latvia                                    |
| <input checked="" type="checkbox"/> BA Bosnia and Herzegovina                | <input checked="" type="checkbox"/> MA Morocco                                   |
| <input checked="" type="checkbox"/> BB Barbados                              | <input checked="" type="checkbox"/> MD Republic of Moldova                       |
| <input checked="" type="checkbox"/> BG Bulgaria                              | <input checked="" type="checkbox"/> MG Madagascar                                |
| <input checked="" type="checkbox"/> BR Brazil                                | <input checked="" type="checkbox"/> MK The former Yugoslav Republic of Macedonia |
| <input checked="" type="checkbox"/> BY Belarus                               | <input checked="" type="checkbox"/> MN Mongolia                                  |
| <input checked="" type="checkbox"/> BZ Belize                                | <input checked="" type="checkbox"/> MW Malawi                                    |
| <input checked="" type="checkbox"/> CA Canada                                | <input checked="" type="checkbox"/> MX Mexico                                    |
| <input checked="" type="checkbox"/> CH and LI Switzerland and Liechtenstein  | <input checked="" type="checkbox"/> MZ Mozambique                                |
| <input checked="" type="checkbox"/> CN China                                 | <input checked="" type="checkbox"/> NO Norway                                    |
| <input checked="" type="checkbox"/> CR Costa Rica                            | <input checked="" type="checkbox"/> NZ New Zealand                               |
| <input checked="" type="checkbox"/> CU Cuba                                  | <input checked="" type="checkbox"/> PL Poland                                    |
| <input checked="" type="checkbox"/> CZ Czech Republic                        | <input checked="" type="checkbox"/> PT Portugal                                  |
| <input checked="" type="checkbox"/> DE Germany                               | <input checked="" type="checkbox"/> RO Romania                                   |
| <input checked="" type="checkbox"/> DK Denmark                               | <input checked="" type="checkbox"/> RU Russian Federation                        |
| <input checked="" type="checkbox"/> DM Dominica                              | <input checked="" type="checkbox"/> SD Sudan                                     |
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| <input checked="" type="checkbox"/> GE Georgia                               | <input checked="" type="checkbox"/> TM Turkmenistan                              |
| <input checked="" type="checkbox"/> GH Ghana                                 | <input checked="" type="checkbox"/> TR Turkey                                    |
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| <input checked="" type="checkbox"/> HU Hungary                               | <input checked="" type="checkbox"/> UA Ukraine                                   |
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| <input checked="" type="checkbox"/> IN India                                 | <input checked="" type="checkbox"/> UZ Uzbekistan                                |
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| <input checked="" type="checkbox"/> KP Democratic People's Republic of Korea |  |
| <input checked="" type="checkbox"/> KR Republic of Korea                     |  |
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Check-box reserved for designating States which have become party to the PCT after issuance of this sheet:



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## Box No. VI PRIORITY CLAIM

☐ Further priority claim is indicated in the Supplemental Box.

Filing date of earlier application (day/month/year)	Number of earlier application	Where earlier application is:		
		national application: country	regional application: * regional Office	international application: receiving Office
item (1) 26/08/1999	9903003-3	Sweden		
item (2)				
item (3)				

☒ The receiving Office is requested to prepare and transmit to the International Bureau a certified copy of the earlier application(s) (only if the earlier application was filed with the Office which for the purposes of the present international application is the receiving Office) identified above as item(s): 1

\* Where the earlier application is an ARIPO application, it is mandatory to indicate in the Supplemental Box at least one country party to the Paris Convention for the Protection of Industrial Property for which that earlier application was filed (Rule 4.10(b)(ii)). See Supplemental Box.

## Box No. VII INTERNATIONAL SEARCHING AUTHORITY

Choice of International Searching Authority (ISA) (if two or more International Searching Authorities are competent to carry out the international search, indicate the Authority chosen; the two-letter code may be used):

Request to use results of earlier search; reference to that search (if an earlier search has been carried out by or requested from the International Searching Authority):

Date (day/month/year)

Number

Country (or regional Office)

ISA /

## Box No. VIII CHECK LIST; LANGUAGE OF FILING

This international application contains the following number of sheets:

request : 4  
description (excluding sequence listing part) : 5  
claims : 1  
abstract : 1  
drawings : 6  
sequence listing part of description : \_\_\_\_\_

Total number of sheets : 17

This international application is accompanied by the item(s) marked below:

- ☒ fee calculation sheet
- ☐ separate signed power of attorney
- ☒ ~~copy of~~ general power of attorney; reference number, if any:
- ☐ statement explaining lack of signature
- ☐ priority document(s) identified in Box No. VI as item(s):
- ☐ translation of international application into (language):
- ☐ separate indications concerning deposited microorganism or other biological material
- ☐ nucleotide and/or amino acid sequence listing in computer readable form
- ☐ other (specify):

Figure of the drawings which should accompany the abstract:

Language of filing of the international application:

## Box No. IX SIGNATURE OF APPLICANT OR AGENT

Next to each signature, indicate the name of the person signing and the capacity in which the person signs (if such capacity is not obvious from reading the request).

Huskvarna 2000-08-17

O-RECEIPT KINDLY REQUESTED!

(H. Siebmans)

For receiving Office use only

1. Date of actual receipt of the purported international application:	2. Drawings:  <input type="checkbox"/> received:  <input type="checkbox"/> not received:
3. Corrected date of actual receipt due to later but timely received papers or drawings completing the purported international application:	
4. Date of timely receipt of the required corrections under PCT Article 11(2):	
5. International Searching Authority (if two or more are competent): ISA /	
6. <input type="checkbox"/> Transmittal of search copy delayed until search fee is paid.	

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**PCT**

**REQUEST**

The undersigned requests that the present international application be processed according to the Patent Cooperation Treaty.

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**PCT/SE 00 / 0 1 5 8 9**

International Application No.

International Filing Date

**1 8 -08- 2000**

**The Swedish Patent Office  
PCT International Application**

Name of receiving Office and "PCT International Application"

Applicant's or agent's file reference  
(if desired) (12 characters maximum) **T 022-316/PC**

**Box No. I TITLE OF INVENTION** ~~[Avzinkningsbeständig mässingslegering för pressgjutning]~~ - A die-casting brass alloy which is resistant to dezincification

**Box No. II APPLICANT**

Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)

**Tour & Andersson Hydronics AB**

**SE-524 80 Ljung**

**SWEDEN**

☐ This person is also inventor.

Telephone No.

Facsimile No.

Teleprinter No.

State (that is, country) of nationality:  
**Sweden**

State (that is, country) of residence:  
**Sweden**

This person is applicant for the purposes of:

☐ all designated States

☒ all designated States except the United States of America

☐ the United States of America only

☐ the States indicated in the Supplemental Box

**Box No. III FURTHER APPLICANT(S) AND/OR (FURTHER) INVENTOR(S)**

Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)

**DÄCKER, Carl-Åke**

**Gröna Vägen 52A**

**SE-541 54 Skövde**

**SWEDEN**

This person is:

☐ applicant only

☒ applicant and inventor

☐ inventor only (If this check-box is marked, do not fill in below.)

State (that is, country) of nationality:  
**Sweden**

State (that is, country) of residence:  
**Sweden**

This person is applicant for the purposes of:

☐ all designated States

☐ all designated States except the United States of America

☒ the United States of America only

☐ the States indicated in the Supplemental Box

☒ Further applicants and/or (further) inventors are indicated on a continuation sheet.

**Box No. IV AGENT OR COMMON REPRESENTATIVE; OR ADDRESS FOR CORRESPONDENCE**

The person identified below is hereby/has been appointed to act on behalf of the applicant(s) before the competent International Authorities as:

☒ agent

☐ common representative

Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)

**H. Siebmanns,**

**GOTAPATENT AB**

**Box 154**

**SE-561 22 Huskvarna**

**Sweden**

Telephone No.

**+46-36-130211**

Facsimile No.

**+46-36-145126**

Teleprinter No.

☐ Address for correspondence: Mark this check-box where no agent or common representative is/has been appointed and the space above is used instead to indicate a special address to which correspondence should be sent.

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1 8 -08- 2000

## Continuation of Box No. III FURTHER APPLICANT(S) AND/OR (FURTHER) INVENTOR(S)

If none of the following sub-boxes is used, this sheet should not be included in the request.

Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)

LANGELÖTZ, Ulla  
Backvägen 6  
SE 6-513 32 Fristad  
SWEDEN

This person is:

- ☐ applicant only  
☒ applicant and inventor  
☐ inventor only (If this check-box is marked, do not fill in below.)

State (that is, country) of nationality:  
Sweden

State (that is, country) of residence:  
Sweden

This person is applicant for the purposes of:

- ☐ all designated States ☐ all designated States except the United States of America ☒ the United States of America only ☐ the States indicated in the Supplemental Box

Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)

This person is:

- ☐ applicant only  
☐ applicant and inventor  
☐ inventor only (If this check-box is marked, do not fill in below.)

State (that is, country) of nationality:

State (that is, country) of residence:

This person is applicant for the purposes of:

- ☐ all designated States ☐ all designated States except the United States of America ☐ the United States of America only ☐ the States indicated in the Supplemental Box

Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)

This person is:

- ☐ applicant only  
☐ applicant and inventor  
☐ inventor only (If this check-box is marked, do not fill in below.)

State (that is, country) of nationality:

State (that is, country) of residence:

This person is applicant for the purposes of:

- ☐ all designated States ☐ all designated States except the United States of America ☐ the United States of America only ☐ the States indicated in the Supplemental Box

Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)

This person is:

- ☐ applicant only  
☐ applicant and inventor  
☐ inventor only (If this check-box is marked, do not fill in below.)

State (that is, country) of nationality:

State (that is, country) of residence:

This person is applicant for the purposes of:

- ☐ all designated States ☐ all designated States except the United States of America ☐ the United States of America only ☐ the States indicated in the Supplemental Box

☐ Further applicants and/or (further) inventors are indicated on another continuation sheet.

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## Box No.V DESIGNATION STATES

The following designations are hereby made under Rule 4.9(a) (mark the applicable check-boxes; at least one must be marked):

## Regional Patent

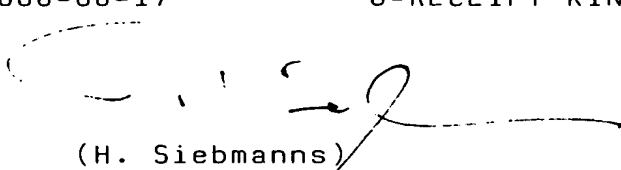
- ☒ AP ARIPO Patent: GH Ghana, GM Gambia, KE Kenya, LS Lesotho, MW Malawi, MZ Mozambique, SD Sudan, SL Sierra Leone, SZ Swaziland, TZ United Republic of Tanzania, UG Uganda, ZW Zimbabwe, and any other State which is a Contracting State of the Harare Protocol and of the PCT
- ☒ EA Eurasian Patent: AM Armenia, AZ Azerbaijan, BY Belarus, KG Kyrgyzstan, KZ Kazakhstan, MD Republic of Moldova, RU Russian Federation, TJ Tajikistan, TM Turkmenistan, and any other State which is a Contracting State of the Eurasian Patent Convention and of the PCT
- ☒ EP European Patent: AT Austria, BE Belgium, CH and LI Switzerland and Liechtenstein, CY Cyprus, DE Germany, DK Denmark, ES Spain, FI Finland, FR France, GB United Kingdom, GR Greece, IE Ireland, IT Italy, LU Luxembourg, MC Monaco, NL Netherlands, PT Portugal, SE Sweden, and any other State which is a Contracting State of the European Patent Convention and of the PCT
- ☒ OA OAPI Patent: BF Burkina Faso, BJ Benin, CF Central African Republic, CG Congo, CI Côte d'Ivoire, CM Cameroon, GA Gabon, GN Guinea, GW Guinea-Bissau, ML Mali, MR Mauritania, NE Niger, SN Senegal, TD Chad, TG Togo, and any other State which is a member State of OAPI and a Contracting State of the PCT (if other kind of protection or treatment desired, specify on dotted line) .....

## National Patent (if other kind of protection or treatment desired, specify on dotted line):

- |  |   |
|--|---|
| <input checked="" type="checkbox"/> AE United Arab Emirates                  | <input checked="" type="checkbox"/> LC Saint Lucia  |
| <input checked="" type="checkbox"/> AG Antigua and Barbuda                   | <input checked="" type="checkbox"/> LK Sri Lanka  |
| <input checked="" type="checkbox"/> AL Albania                               | <input checked="" type="checkbox"/> LR Liberia  |
| <input checked="" type="checkbox"/> AM Armenia                               | <input checked="" type="checkbox"/> LS Lesotho  |
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| <input checked="" type="checkbox"/> BA Bosnia and Herzegovina                | <input checked="" type="checkbox"/> MA Morocco  |
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| <input checked="" type="checkbox"/> KG Kyrgyzstan                            | <input checked="" type="checkbox"/> ZW Zimbabwe   |
| <input checked="" type="checkbox"/> KP Democratic People's Republic of Korea | <input type="checkbox"/> Check-box reserved for designating States which have become party to the PCT after issuance of this sheet: |
| <input checked="" type="checkbox"/> KR Republic of Korea                     |   |
| <input checked="" type="checkbox"/> KZ Kazakhstan                            |   |

**Precautionary Designation Statement:** In addition to the designations made above, the applicant also makes under Rule 4.9(b) all other designations which would be permitted under the PCT except any designation(s) indicated in the Supplemental Box as being excluded from the scope of this statement. The applicant declares that those additional designations are subject to confirmation and that any designation which is not confirmed before the expiration of 15 months from the priority date is to be regarded as withdrawn by the applicant at the expiration of that time limit. (Confirmation (including fees) must reach the receiving Office within the 15-month time limit.)

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<b>Box No. VI PRIORITY CLAIMS</b>		<input type="checkbox"/> Further priority claims are indicated in the Supplemental Box.		
Filing date of earlier application (day/month/year)	Number of earlier application	Where earlier application is:		
		national application: country	regional application: regional Office	international application: receiving Office
item (1) 26 August 1999 26/08/1999	9903003-3	Sweden		
item (2)				
item (3)				
<input checked="" type="checkbox"/> The receiving Office is requested to prepare and transmit to the International Bureau a certified copy of the earlier application(s) (only if the earlier application was filed with the Office which for the purposes of the present international application is the receiving Office) identified above as item(s): <u>1</u>				
<small>* Where the earlier application is an ARIPO application, it is mandatory to indicate in the Supplemental Box at least one country party to the Paris Convention for the Protection of Industrial Property for which that earlier application was filed (Rule 4.10(b)(ii)). See Supplemental Box.</small>				
<b>Box No. VII INTERNATIONAL SEARCHING AUTHORITY</b>				
<b>Choice of International Searching Authority (ISA)</b> <small>(if two or more International Searching Authorities are competent to carry out the international search, indicate the Authority chosen; the two-letter code may be used):</small>		<b>Request to use results of earlier search; reference to that search (if an earlier search has been carried out by or requested from the International Searching Authority):</b> Date (day/month/year)      Number      Country (or regional Office)		
ISA /				
<b>Box No. VIII CHECK LIST; LANGUAGE OF FILING</b>				
This international application contains the following number of sheets: request : 4 ✓ description (excluding sequence listing part) : 5 ✓ claims : 1 ✓ abstract : 1 ✓ drawings : 6 ✓ sequence listing part of description : Total number of sheets : 17 ✓		This international application is accompanied by the item(s) marked below: 1. <input checked="" type="checkbox"/> fee calculation sheet 2. <input type="checkbox"/> separate signed power of attorney 3. <input checked="" type="checkbox"/> <del>copy of</del> general power of attorney; reference number, if any: 4. <input type="checkbox"/> statement explaining lack of signature 5. <input type="checkbox"/> priority document(s) identified in Box No. VI as item(s): 6. <input type="checkbox"/> translation of international application into (language): 7. <input type="checkbox"/> separate indications concerning deposited microorganism or other biological material 8. <input type="checkbox"/> nucleotide and/or amino acid sequence listing in computer readable form 9. <input type="checkbox"/> other (specify):		
Figure of the drawings which should accompany the abstract:		Language of filing of the international application:		
<b>Box No. IX SIGNATURE OF APPLICANT OR AGENT</b>				
<small>Next to each signature, indicate the name of the person signing and the capacity in which the person signs (if such capacity is not obvious from reading the request).</small> Huskvarna 2000-08-17      O-RECEIPT KINDLY REQUESTED!  (H. Siebmans)				

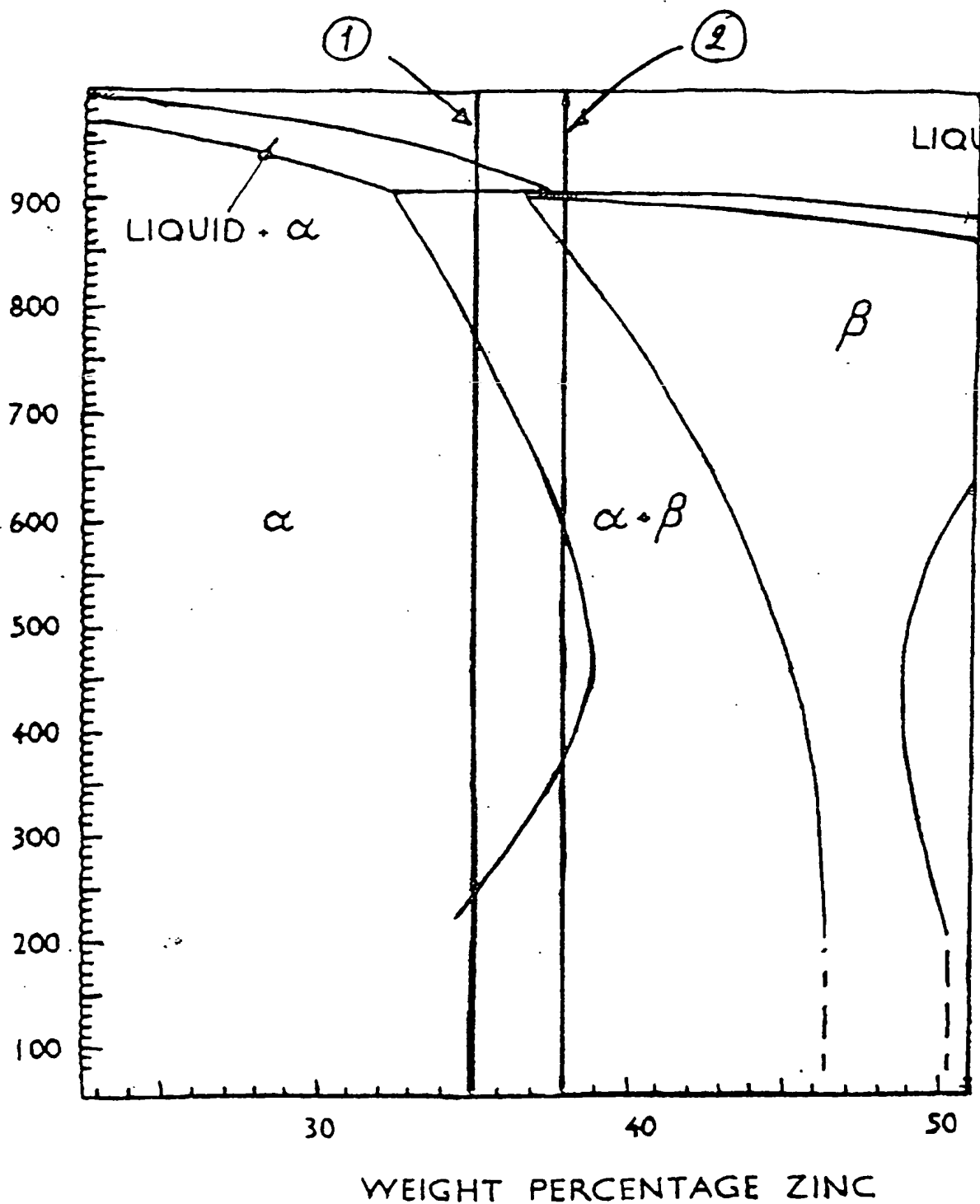
For receiving Office use only		2. Drawings:  <input checked="" type="checkbox"/> received:  <input type="checkbox"/> not received:
1. Date of actual receipt of the purported international application:	18-08-2000	
3. Corrected date of actual receipt due to later but timely received papers or drawings completing the purported international application:		
4. Date of timely receipt of the required corrections under PCT Article 11(2):		
5. International Searching Authority (if two or more are competent): ISA / SE	6. <input type="checkbox"/> Transmittal of search copy delayed until search fee is paid.	

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FIG 1



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Hot-learing tendencies and the binary  
copper-zinc phase diagram

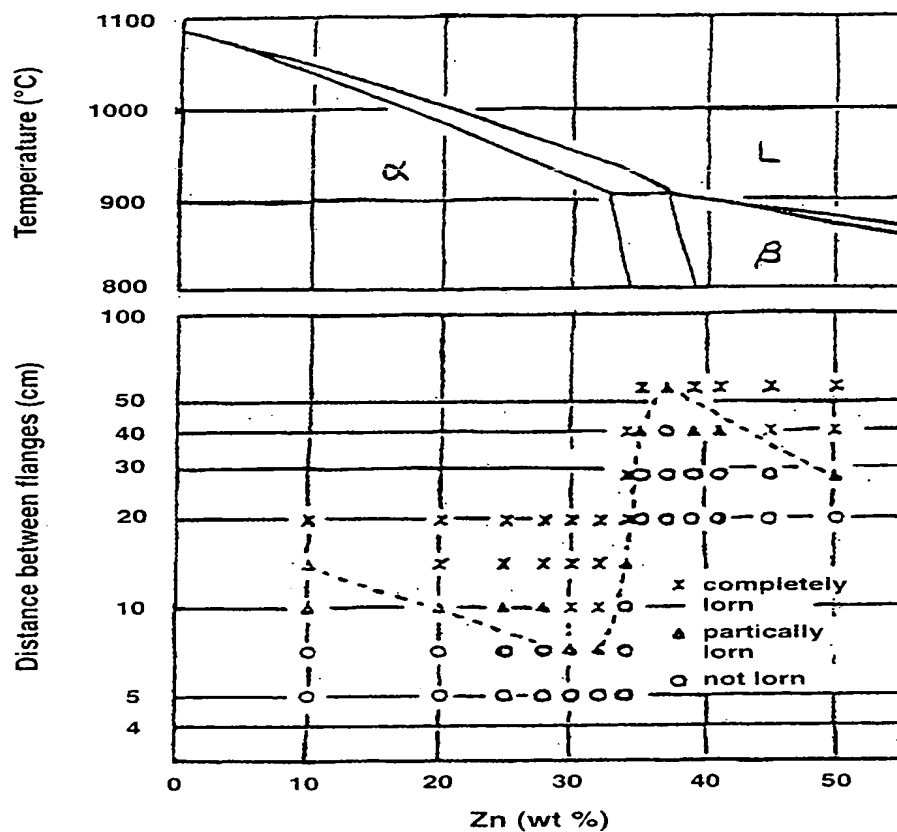


FIG 2

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The result of the dezincification tests.

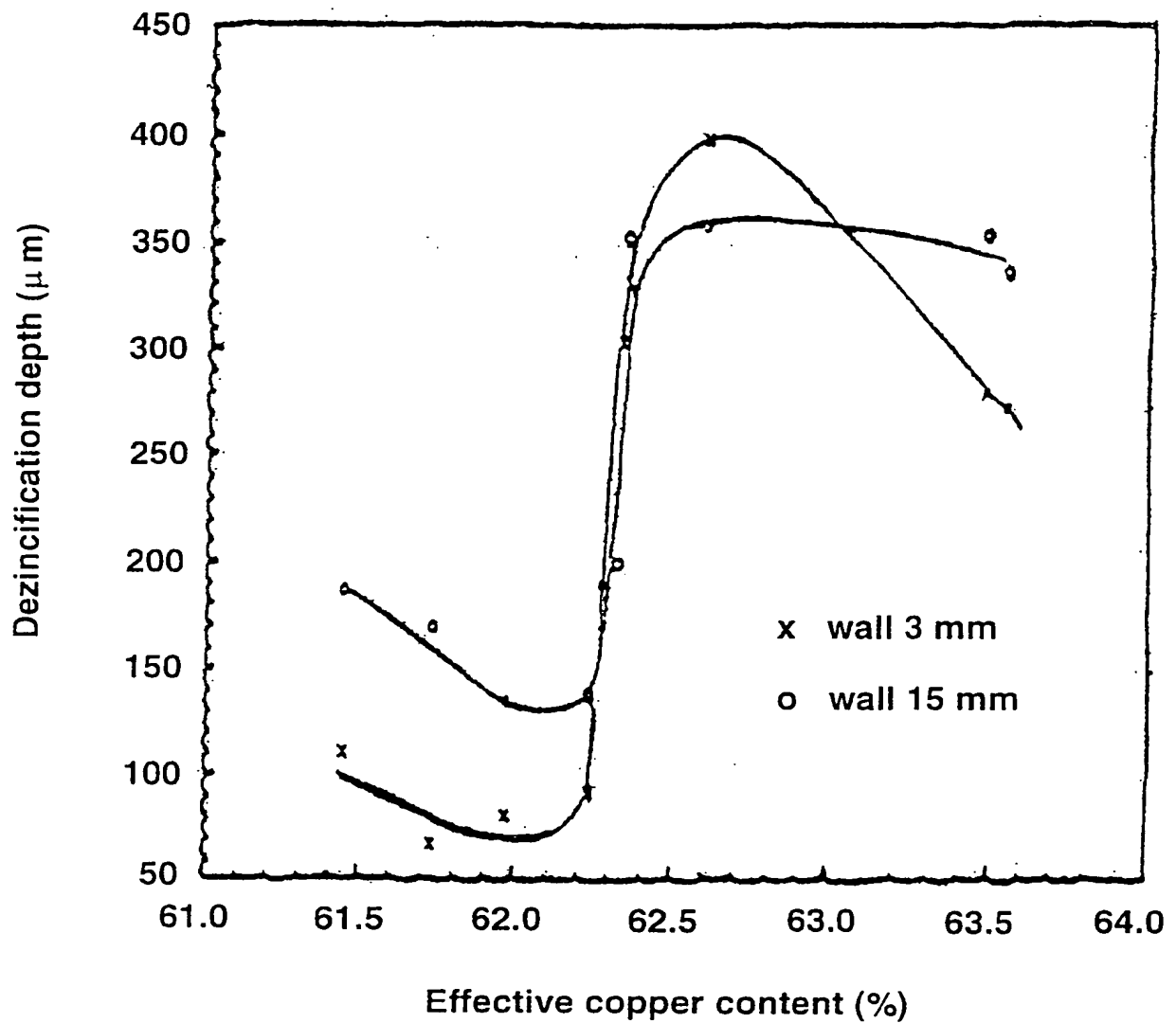


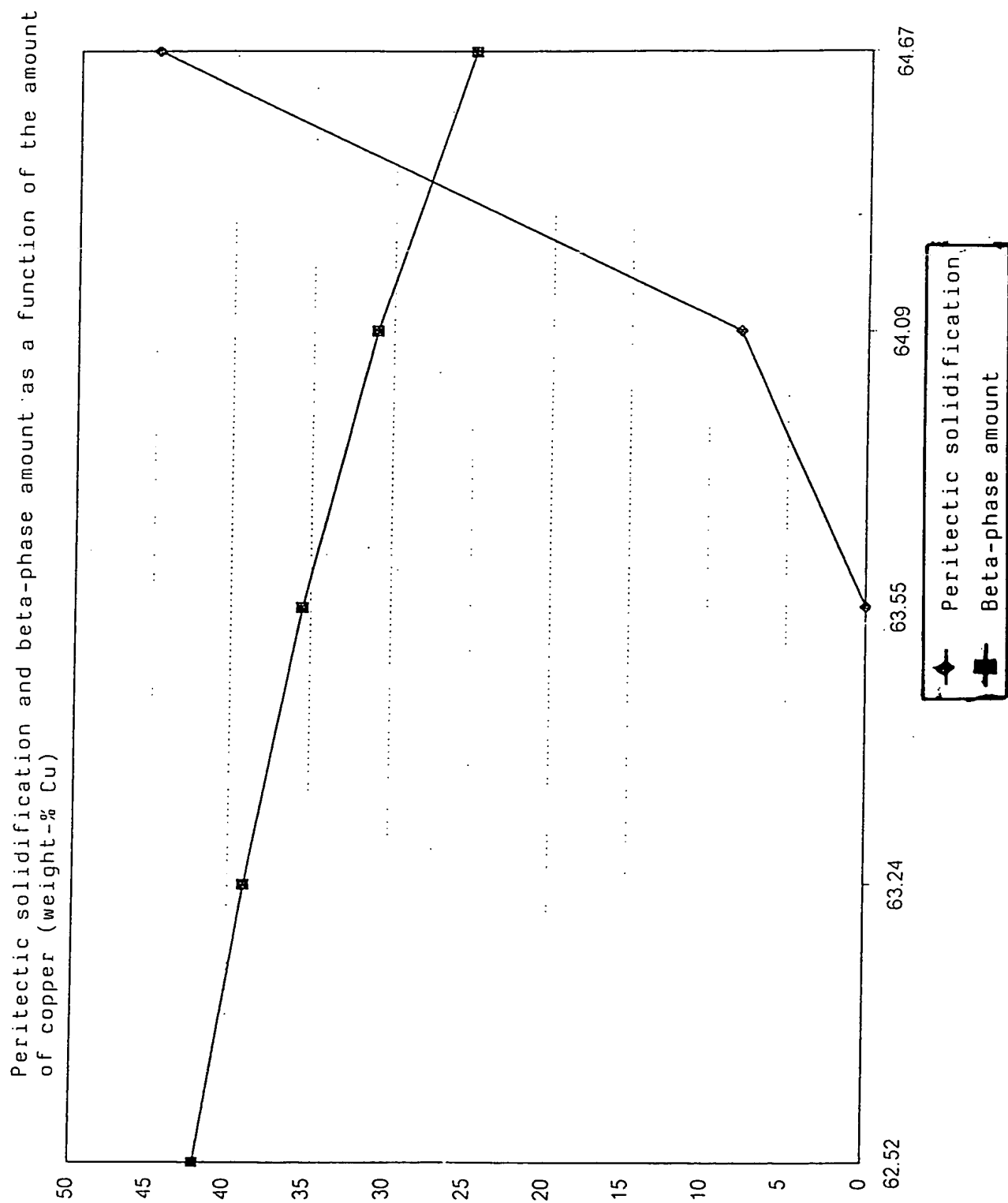
FIG 3

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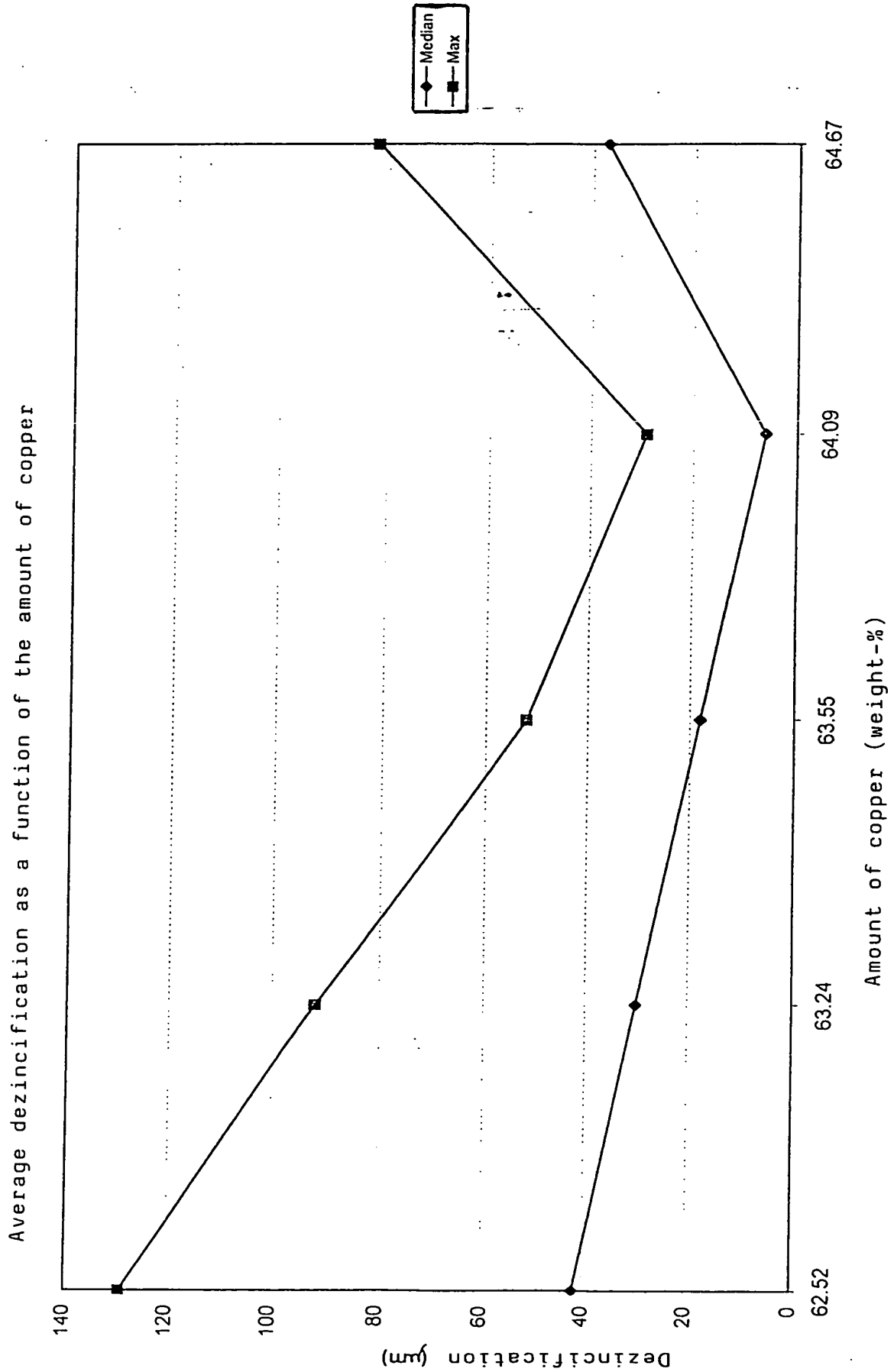
FIG 4



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FIG 5

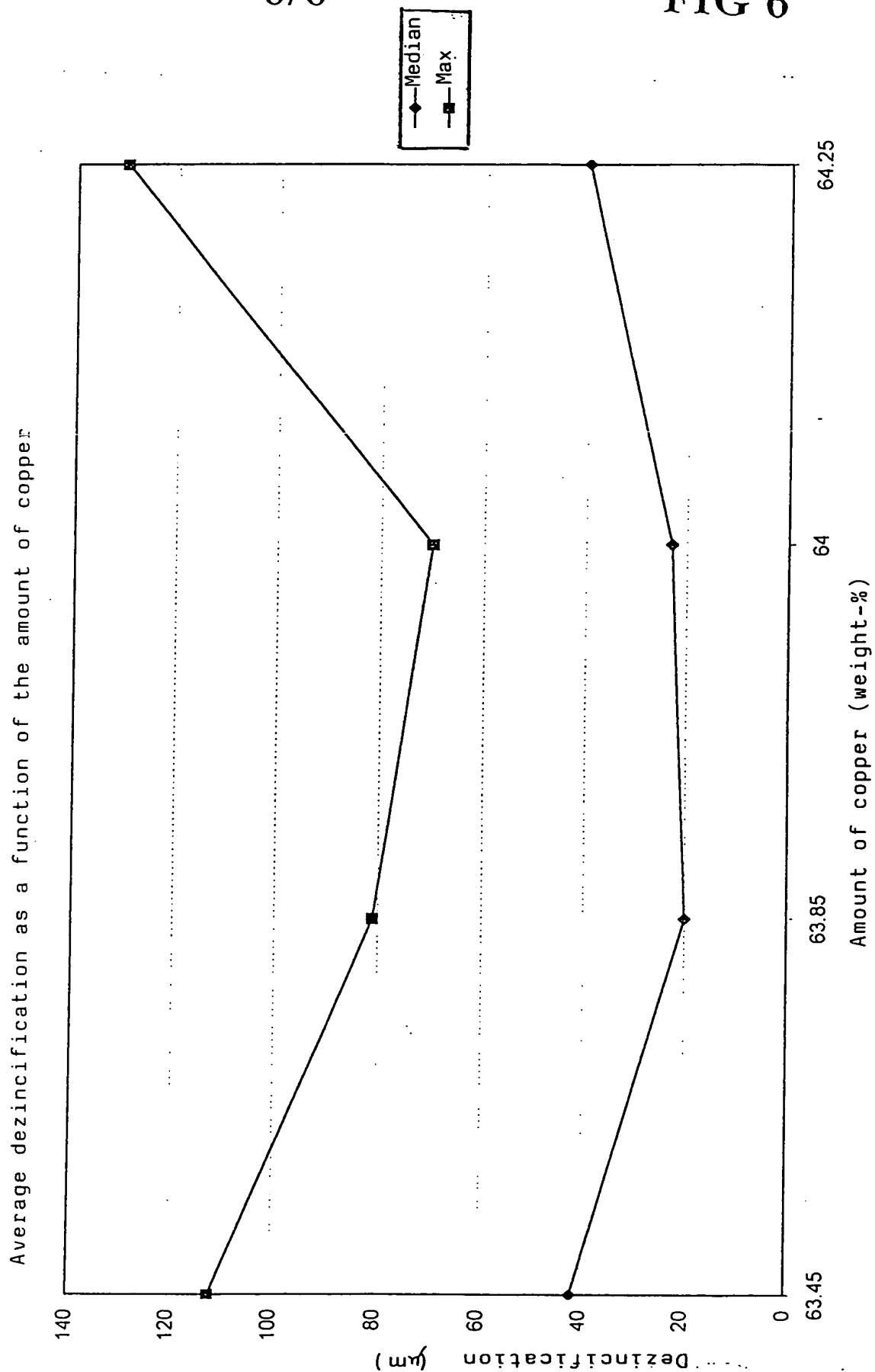


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FIG 6



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**Avzinkningsbeständig mässingslegering för pressgjutning**

Föreliggande uppfinning avser en avzinkningsbeständig mässingslegering för pressgjutning enligt ingressen till patentkravet 1.

5

Avzinkning är ett problem för mässingsarmatur, då vattenkvaliteten varierar och kan vara kraftigt korrosiv.

10

Det är väl känt, att den kopparrika alfa-fasen i mässing går att inhibera mot avzinkning med hjälp av små tillsatser av arsenik eller antimon, medan den zinkrika beta-fasen ej är avzinkningsbeständig.

15

Det vore därför logiskt att ha en hög halt av koppar i en avzinkningsbeständig mässingslegering (som legering 1 i Fig 1 visande del av fasdiagrammet Cu-Zn, Hansen, Constitution of binary alloys, New York 1958) för att minimera eller helt undvika andelen av den korrosionssvaga beta-fasen. Problemet med en sådan legering är att den medför ett primärt stelnande i alfa-fas i form av långa stelningskristaller, så kallade dendriter, vilket innebär, att betafasen kommer att lägga sig i långa stråk mellan alfa-dendriterna. Detta medför två negativa konsekvenser:

20

a) Materialet blir varmskört;

b) Materialet får djup avzinkning, då denna följer de långa beta-fasstråken.

25

Detta fenomen är väl beskrivet i följande vetenskapliga artikel:

Arno Louvo, Tapio Rantala, Veijo Rauta

"The effect of composition on as-cast microstructure of alfa/beta-brass and its control by microcomputer".

LISBOA 84, 51ST International Foundry Congress.

30

Figur 2, som är tagen från denna artikel, beskriver problemet med varmskörhet och figur 3, som är tagen från samma artikel, fenomenet med ökade avzinkningsdjup med ökande kopparhalt.

För att undvika ovanstående problem måste legeringen stelna primärt i beta-fas som legering 2 i fig 1, vilket ger följande fördelar:

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a) Andel mikro- och makrosegringar blir betydligt lägre för en legering som stelnar primärt i beta-fas. Detta beror på att diffusionshastigheten i beta-fas är ca 1000 ggr högre än i alfa-fas vilket är en följd av att dess kristalluppbyggnad har en atomanordning enligt bcc (body-centered-cubic) jämfört med alfa-fasens fcc (face-centered-cubic).

5

b) Stelningskristallerna låter sig finkornbehandlas med bor som är en mycket effektiv finkornbildare och det behövs ytterst små mängder av detta ämne för att ge en finkornsbildande effekt. Det har visat sig erfarenhetsmässigt att bor ej har en finkornsbildande effekt på mässing som stelnar primärt i alfa-fas medan den är mycket effektiv i att kärnbilda beta-kristaller.

10

Nackdelen är, att betafasandelen ökar i den slutliga gjutstrukturen och utan värmebehandling är det svårt att klara de hårdaste avzink-ningskraven enligt BS 2872, som föreskriver max avzinknings-djup 100 µm för enskilt värde. Detta gäller framförallt för grövre godstjocklekar, vilket ses i figur 3.

15 Ovanstående är välkända bakgrundsfakta.

Ytterligare tidigare känd teknik framgår av WO 89/08725 A1, EP 0 572 959 A1 och MNC handbok nr 8, utgåva 2, september 1987, "Specialmässing", sidan 43.

20 Syftet med föreliggande uppfinning är elimineringen av ovanstående olägenheter.

Detta syftemål förverligas enligt uppfinningen genom skapandet av en legering med följande egenskaper:

25 Genom en skicklig balansering av koppar, zink, kisel och aluminium kan man uppnå ett stelnande i beta-fas och ändå undgå att få sammanhängande betafasområden i den slutliga produkten. Betafasen kommer att ligga som isolerade agglomerat i en grundmassa av alfa-fas som är inhiberad mot avzinkning genom arseniktillsatsen. Primärt stelnande i beta-fas med patentets legeringskombination kombinerat med pressgjutningens höga stelningshastighet begränsar storleken på agglomeraten av  
30 beta-fas i den slutliga gjutstrukturen så att de även för tjockt pressgjutgods med låg stelningshastighet får en utsträckning som är klart mindre än 100 µm.

Genom finkornbehandling med bor kan agglomeratens storlek och därmed avzinkningens djup ytterligare minskas.

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Dessa slutsatser bekräftas av resultat från ett mångårigt och omfattande utvecklingsarbete för att hitta rätta legeringskombinationer. Detta illustreras av följande ritningsfigurer:

Figur 4 beskriver hur andelen peritektiskt stelnande (stelnande primärt i alfa-fas) snabbt avtar när kopparhalten i legeringen minskas medan ökningen av andel i beta-fas i den slutgiltiga strukturen ökar relativt långsamt.

Figur 5 visar resultatet från undersökningar av avzinkningsdjup utförda enligt den internationella standarden ISO 6509 för pressgjutna detaljer med 6 mm:s godstjocklek för legeringen med varierande halt Cu. Resultatet är entydigt, man uppnår ett minimum i avzinkning just i det område där det peritektiska stelnandet upphör samtidigt som beta-fasandelen ännu ej blivit för stor. Figuren visar avzinkningsdjup både för maximalt enskilt värde samt medianvärden för ett antal mätningar gjorda på samma provningsobjekt. Resultatet är att man i ett ganska brett område understiger kravet beträffande avzinkningshårdighet enligt BS 2872 på maximalt 100 µm för enskilt värde.

Ambitionen med uppfinningen är en legering som även klarar avzinkningskraven för tjockt pressgjutgods och figur 6 visar resultatet för motsvarande undersökning med 16 mm:s godstjocklek. Även för denna godstjocklek klaras kravet på maximalt 100 µm för enskilt värde fast inom ett smalare intervall.

\* Vid Cu-halter understigande ca 63,6 % blir beta-fas agglomeraten så stora att de börjar växa ihop vilket medför att avzinkningsdjupet blir för stort.

\* Vid Cu-halter överstigande ca 64,1 % blir andelen primärt stelnande i alfa-fas så hög att långa betafasstråk utvecklas mellan alfa-kristallerna med därtill hörande djup avzinkning.

Det positiva resultatet från denna balansering av legeringsämnen sammanfattas enligt nedan:

1) Pressgjutet gods tillverkat av legeringen klarar utan efterföljande värmebehandling kraven enligt BS 2872 om maximalt avzinkningsdjup på 100 µm för enskilt värde.

2) Legeringen låter sig effektivt finkornbehandlas med bor vilket medför en mycket finkornig struktur i den färdiga produkten vilket ger två fördelar:

\* Avzinkningshårdigheten förbättras ytterligare då beta-fas agglomeratens storlek minskas ytterligare.

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\* Porositeten i gjutgodset får en bättre fördelning och mindre enskild storlek vilket minskar risken för otätt gjutgods och därmed också nedbringar kassationskostnaderna för produkter med krav på trycktäthet.

- 5 3. Aluminiuminnehållet kan hållas på en låg nivå, 0,03-0,1 vikt-%, vilket gör att man utnyttjar aluminiumtillsatsens positiva effekt på en pressgjutlegering men undviker de negativa effekterna.
- \* Positiva effekter är aluminiums starka desoxiderande effekt vilket medför att även vid en låg halt av aluminium är syreinnehållet i smältan stabilt mycket låg. Aluminium även i små halter har också en renande effekt i så form att den minskar zinkoxidbeläggning på smältskopor, formverktyg och kärnor.
- 10 \* Negativa effekter är att vid aluminiumhalter överstigande 0,1 vikt-% bildas i legeringar innehållande kisel en seg slagg bestående av aluminiumsilikater. Vid smältpåföring med skopa kommer en del av denna slagg att följa med in i produkten där den bildar "slöjor" och "nystan". Dessa inneslutningar försämrar de mekaniska egenskaperna hos slutprodukten men vad värre är att de fungerar som kapillärer vilket medför att avzinkningen följer inneslutningarna om de når till ytan vilket får till följd
- 15 djupa avzinkningar som långt överstiger kraven beträffande avzinkningshårdighet enligt BS 2872 om maximalt 100 µm avzinkning för enskilt värde.

I detta avseende skiljer sig föreliggande uppfinning från den finkornbehandlande legeringen enligt DE-A 43 18 377 A1, som förespråkar en aluminiumhalt på 0,3-0,7 vikt-% och en kiselhalt på 0,-0,7 vikt-%.

20 %.

Avzinkningshårdig legering enligt uppfinningen kännetecknas av följande sammansättningar:

	Cu:	63,0-65,5	vikt-%
25	Pb:	1,5-2,2	vikt-%
	Si:	0,6-0,9	vikt-%
	Al:	0,03-0,1	vikt-%
	As:	0,03-0,1	vikt-%
	Ni:	max 0,5	vikt-%
30	Sn:	max 0,5	vikt-%
	Fe:	0,1-0,5	vikt-%
	B:	0-15 ppm	
	Övriga föroreningar:	max 0,3 vikt-%	
	Zn:	Rest	

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Exempel på specifierad legering som under längre tids produktion i full skala har visat sig väl leva upp till kraven enligt uppfinningen:

	Cu:	63,6	vikt-%
5	Pb:	1,8	vikt-%
	Si:	0,73	vikt-%
	Al:	0,07	vikt-%
	As:	0,06	vikt-%
	Ni:	0,2	vikt-%
10	Sn:	0,3	vikt-%
	Fe:	0,25	vikt-%
	B:	8 ppm	
	Övriga föroreningar: max 0,3 vikt-%		
	Zn:	Rest	

15

Uppfinningen är inte begränsad till ovan angivna föredragna utföringsexempel utan kan modifieras och kompletteras på godtyckligt sätt inom ramen för uppfinningstanken och följande patentkrav. Detta gäller särskilt blyhalten, då bly ej löses in i legeringen utan ligger som en separat fas som ej påverkar avzinkningshårdigheten. Detta medför att om man sänker blyhalten under det angivna intervallet så

20

måste övriga legeringselement justeras stökiometriskt.

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## PATENTKRAV

1. Mässingslegering för pressgjutning med avzinkningshårdighet understigande 100  $\mu\text{m}$  för enskilt värde enligt Brittisk Standard BS 2872 i gjuttillstånd (dvs utan efterföljande fasomvandlande

5 värmebehandling) **k ä n n e t e c k n a d a v** följande sammansättning:

	Cu:	63,0-65,0	vikt-%
	Pb:	1,5-2,2	vikt-%
	Si:	0,6-0,9	vikt-%
10	Al:	0,03-0,1	vikt-%
	As:	0,03-0,1	vikt-%
	Ni:	max 0,5	vikt-%
	Sn:	max 0,5	vikt-%
	Fe:	0,1-0,5	vikt-%
15	B:	0-15 ppm	
	Övriga föroreningar: max 0,3 vikt-%		
	Zn:	Rest	

2. Mässingslegering för pressgjutning enligt patentkravet 1 med avzinkningshårdighet understigande  
20 100  $\mu\text{m}$  för enskilt värde enligt Brittisk Standard BS 2872 i gjuttillstånd (dvs utan efterföljande fasomvandlande värmebehandling) **k ä n n e t e c k n a d a v** följande sammansättning:

	Cu:	63,6	vikt-%
	Pb:	1,8	vikt-%
25	Si:	0,73	vikt-%
	Al:	0,07	vikt-%
	As:	0,06	vikt-%
	Ni:	0,2	vikt-%
	Sn:	0,3	vikt-%
30	Fe:	0,25	vikt-%
	B:	8 ppm	
	Övriga föroreningar: max 0,3 vikt-%		
	Zn:	Rest	

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## **SAMMANDRAG**

Föreliggande uppfinning avser en mässingslegering för pressgjutning med avzinkningshårdighet understigande 100 µm för enskilt värde enligt Brittisk Standard BS 2872 i gjuttillstånd (dvs utan efterföljande fasomvandlande värmebehandling). Legeringen enligt uppfinningen kännetecknas av följande sammansättning:

	Cu:	63,6	vikt-%
	Pb:	1,8	vikt-%
10	Si:	0,73	vikt-%
	Al:	0,07	vikt-%
	As:	0,06	vikt-%
	Ni:	0,2	vikt-%
	Sn:	0,3	vikt-%
15	Fe:	0,25	vikt-%
	B:	8 ppm	
	Övriga föroreningar: max 0,3 vikt-%		
	Zn:	Rest	

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